EFFICACY AND ACCEPTABILITY OF AN ONLINE INTERVENTION TO INCREASE PHYSICAL ACTIVITY AND PERCEIVED BEHAVIOURAL CONTROL

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Declaration

I declare that all of the work included in this thesis is my own, except where otherwise stated. No portion of this work has been, or will be, submitted for any other degree or professional qualification.

Wendy Maltinsky

Acknowledgements

This has been a long journey. Many things have happened over the last few years and sometimes the final goal appeared rather distant. I have many people to thank for the encouragement at each milestone on the way.

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Abbreviations

ACPS	Action and Coping Plan Measurement
BB	Blackboard
BMI	Body Mass Index
HAP	Health Action Planning Tool (The intervention module)
INT	Intervention
INTSS	Intervention and practitioner support
PA	Physical Activity
PBC	Perceived Behavioural Control
RCT	Randomly controlled trial
SE	Self-efficacy
SS	Practitioner support
TA	Thematic Analysis
TPB	Theory of Planned Behaviour
UHI	University of the Highlands and Islands
VLE	Virtual Learning Environment

Abstract

Aim: Physical activity has long been recognised as a means of enhancing and protecting health, but the levels of engagement are far from optimal in Scotland. Previous research has demonstrated that increasing perceived behavioural control alongside the use of action and coping plans can be effective in changing physical activity behaviour. The aim of this study was to evaluate the efficacy and acceptability of combined techniques for planning and increasing perceived behavioural control alongside assessing the need for practitioner support for online intervention delivery. This study also set to examine the relationship between the targets that individuals set and how these compare to behavioural outcomes, which previously had not been undertaken.

Method: An online intervention designed to increase perceived behavioural control and support the creation of action and coping plan was delivered over two weeks in a 2 x 2 factorial random allocation study. The two factors were practitioner support and the intervention with a fourth group acting as a control. Participants completed a pre and post-test theory of planned behaviour questionnaire and recorded physical activity over 4 weeks using pedometers and self-report diaries.

Results: PBC increased across all participants however there was no statistically significant difference between conditions and so this increase could not be attributed to the intervention. A trend of increased walking was observed in the intervention and practitioner support condition. However while the differences were bordering on being clinically significant, they did not reach statistically significant difference. Of those who completed action and coping plans, 73 % achieved self-set targets. Acceptability of the intervention was high with 79% indicating that they would use it again, and recommend it to others.

Conclusion: Examining action and coping plans revealed that individuals will set moderate goals in response to an intervention guiding them to do so and incrementally increase towards these. Longer time-frames may be able to reveal a gradual increase of physical activity engagement which can be of benefit to health, over and above the effects of participation in a physical activity study.

Chapter 1: Introduction: Physical Activity Behaviour Change

1.1 Introduction

The health of Scotland is all too frequently headline news due to the extreme positions it occupies on international ranking scales of health behaviour and health status (Lawder et al., 2010; Leon et al., 2003). Scotland exceeds other Western European countries in the number of female deaths due to cirrhosis of the liver ((Whyte & Ajetunmobi, 2012); ranks eighth on international scales of alcohol consumption (Scottish Government, 2008a); has the lowest life expectancy of those countries (Whyte & Ajetunmobi, 2012); and the level of obesity is one of the highest of all developed countries (Scottish Government, 2009). It is these figures which underlie the concern of the Scottish Government and which have incentivised the development of a range of campaigns and polices to impede the rise in long term health conditions and health risk behaviours (e.g. Scottish Government, 2008b).

Physical activity (PA) is an evidence-based means of mitigating several health conditions (Warburton, Nicol, and Bredin, 2006). Scotland has invested extensively in strategies and interventions designed to increase PA such as the Healthy Eating, Active Living Action Plan (Scottish Government, 2008b). PA growth however, has only been moderate, and largely witnessed in higher socio-economic populations (ScotPHO, 2012a). Where interventions are informed by health psychology theory however, these appear to be more effective than those which are atheoretical (Greaves et al., 2011; Webb, Joseph, Yardley, & Michie, 2010).

The following chapters (1 – 3) examine the context and literature base of PA interventions in terms of intervention theory, techniques and delivery in order to adequately inform the development of an internet delivered theoretically-informed PA intervention to be employed in this study.

1.2. Background and Context: Health Behaviours and consequences

Health risk behaviours, such as smoking, alcohol consumption, sedentary lifestyles and diets rich in saturated fats are known as behavioural pathogens (Matarazzo, 1994). They are now widely accepted as being major determinants

of health status (van Dam, Li, Spiegelman, Franco, & Hu, 2008) and are believed to contribute as much variance as heritable quotients to population health (Lantz et al., 1998; Wardle & Steptoe, 2003) in the form of increased incidences of, for example, type 2 diabetes, chronic obstructive pulmonary disease (COPD), cancer, and cardiovascular disease (CVD) (Dixon, 2010). These health risk behaviours account for a substantial proportion of the health burden on the National Health Service (Scarborough et al., 2011).

Sedentary activity and diets rich in saturated fat are two central determinants of obesity (Pomerleau et al., 2008). Figures for obesity as illustrated in Figure 1.1, show continued and rapid growth (Scottish Government, 2011). The numbers of people classed as overweight (a body mass index (BMI) of 25 - 29) or obese (a BMI of over 30) increased from 52.4% to 63.3% in the 16 – 64 age group in the period between 1995 and 2010 (Scottish Government, 2011). By 2010, nearly two thirds of the population could be classified as overweight or obese.

Obesity accounts for up to 47% of the attribution of type 2 diabetes (ScotPHO, 2012b). A BMI of over 30 is a risk factor for several other non-communicable diseases such as heart disease and stroke, as well as certain types of cancer (Bianchini, Kaaks, & Vainio, 2002; Pencina, D'Agostino RB, Larson, Massaro, & Vasan, 2009). Obesity is associated with increased risks for gout and osteoarthritis, high blood pressure, kidney failure while also posing a risk to psychological health and wellbeing (World Health Organisation, 2012).

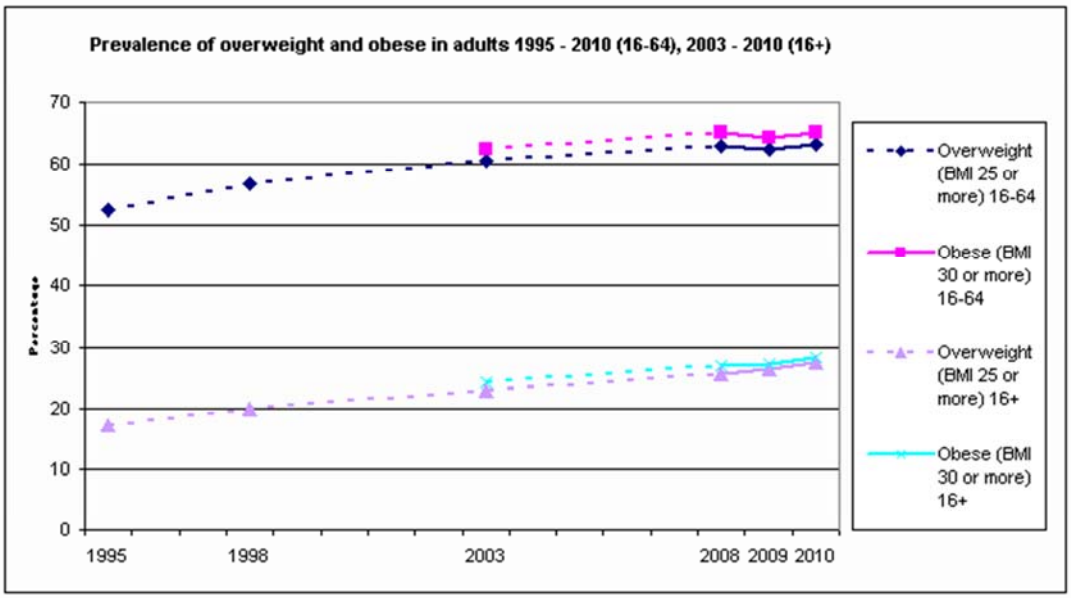

Figure 1.1: Obesity prevalence 1995 – 2010 for adults 16 and over (Scottish Government, 2011)

Ultimately the condition of obesity reflects energy intake which exceeds energy expenditure (Rennie, Johnson, & Jebb, 2005). One way of tackling this national concern, is by introducing interventions to increase PA (van Sluijs et al., 2009).

1.3 Background and Context: Physical Activity

Physical activity has been credited with providing extensive benefits to health such as reducing risks of several long term conditions (Laaksonen et al., 2005; Li et al., 2008), improving psychological wellbeing (Warburton, Nicol, & Bredin, 2006), and reducing incidence of falling in the elderly (Marcus et al., 2006). Even moderate levels of exercise can reduce mortality risks from cardiovascular disease (Chandrashekhar & Anand, 1991). PA is also beneficial to establishing healthy weight management and can therefore help to offset obesity figures (Butryn, Webb, & Wadden, 2011; Rennie et al., 2005).

Public health guidelines recommend that individuals engage in 30 minutes of moderate to vigorous PA 5 times a week (World Health Organisation, 2010). Encouragingly there has been a modest percentage increase in participation in PA in bouts of 15 minutes or more by males between the ages of 16-74 between 2003 and 2008 (Scottish Government, 2011). A compatible increase was also witnessed in females of the same age in the same time frame (Scottish Government, 2011). However, the percentage of females engaging in PA was

less even at its peak (39%) compared to that of men (45%), which can be seen in figure 1.2 (Scottish Government, 2011).

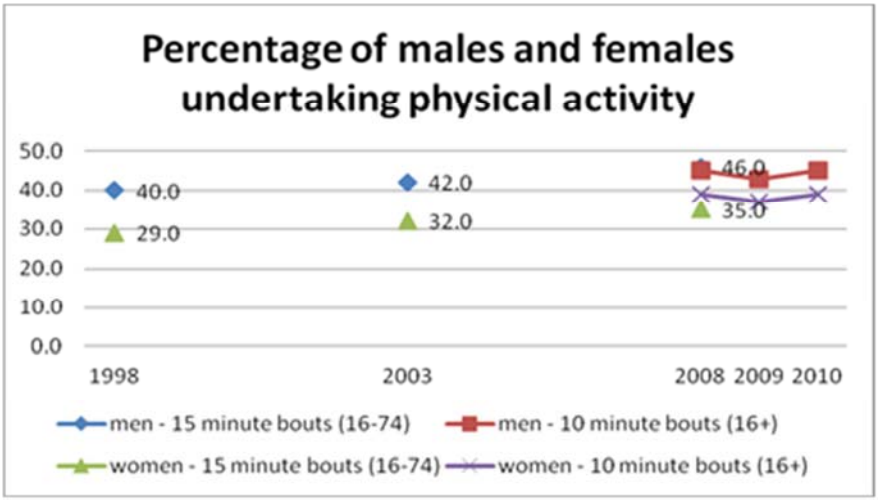

Figure 1.2: Percentage of men and women participating in PA in bouts of 15 and 10 minutes. (Scottish Government, 2011)[1]

Despite the moderate increases in PA since 1998, the target set by the Scottish Government of aiming to have 50% of the population undertaking vigorous or moderate exercise for 150 minutes per week by 2022 remains a long way off (Scottish Government, 2011). PA engagement is suboptimal from the level required to be able to make a substantial impact on health (Foster, Hillsdon, Thorogood, Kaur, & Wedatilake, 2005).

The slow and sometimes only negligible growth of PA, reflects the challenges facing intervention designers; changing health behaviours, regardless of whether it is PA or other forms of health improvement, is not simple (Abraham, Kelly, West, & Michie, 2009; Schwarzer, 2008). Individuals who opt to alter existing behaviours struggle to maintain new routines and many revert to previous poor habits (De Ridder & De Wit, 2006). Standard medical practice offering guidance and advice often leads to no change (Bandura, 2005) and intervention techniques such as education only, continue to be used despite limited evidence of efficacy (Marteau, Ogilvie, Roland, Suhrcke, & Kelly, 2011). PA intervention research therefore is charged with the need to isolate the techniques, contexts, delivery methods, and match these to population groups and target behaviours

[1] Age at measurement was within the band for 16 - 74 in 1998 and 2003. In 2008, 2009 and 2010, no upper age limit

in order to determine the effective mechanisms to enhance PA behaviour change (Michie & Johnston, 2012).

PA systematic reviews which attempt to consolidate previous evidence from PA interventions have struggled to isolate the operational mechanisms, and some have recorded only small effect sizes (Davies, Spence, Vandelanotte, Caperchione, & Mummery, 2012). Scrutiny of theory was omitted in this review which may, in part, account for the difficulty in determining the effective techniques. In this systematic review of PA digital interventions which did not examine whether theory was used, the mean effect size accounted for by the interventions was recorded at 0.14 (Davies et al., 2012). In a comparable systematic review, where theory was examined, the observed effect size was 0.16 for atheoretical interventions, and 0.36 where theory was used (Webb et al., 2010). Evidence emerging from meta-analyses such as these, indicate that health psychology theory can offer a more robust approach to understanding, examining and intervening in changing health behaviour (Albarracín et al., 2005; Greaves et al., 2011; Michie, Abraham, Whittington, McAteer, & Gupta, 2009). Establishing the relationship between the technique and the theory used and its appropriateness for the population, the behaviour, and the context, however, is critical (Marteau et al., 2011; Michie & Abraham, 2004).

1.4 Summary

Health status in Scotland has much room for improvement as revealed in the extensive engagement in health risk behaviour (Scottish Government, 2009a) as well as the increase in long term condition prevalence (e.g. Scottish Government, 2009b). Engaging in PA can help to mitigate and protect health (Scottish Government, 2011). Though some increases in PA have been witnessed in response to interventions, these are neither consistent nor widespread (Scottish Government, 2011). Interventions using health psychology theory to inform the intervention appear to be more effective than interventions which either do not use theory or do not demonstrate how theory has been used (Gardner, Whittington, McAteer, Eccles, & Michie, 2010; Michie & Prestwich, 2010). The following chapter examines PA research to identify the properties required for effective interventions from a health psychology perspective, with specific attention to constructing a robust PA internet intervention for this study.

Chapter 2: Physical Activity Intervention Research

2.1 Introduction:

The previous chapter examined the background and exigencies for developing interventions to increase PA. This chapter examines PA intervention research in the context of health psychology in order to determine the effective components of a PA internet intervention for use in this study.

2.2. Background and Context: Physical Activity Interventions; What Works?

The development and examination of interventions to increase PA has been the subject of considerable research (Armitage, 2005; Hardcastle, Taylor, Bailey, & Castle, 2008; Kahn et al., 2002; Ogilvie et al., 2007; D. M. Williams et al., 2008). Despite this profusion of research, the specificity of intervention characteristics that will lead to successful PA engagement across a broad population spectrum has been obscured because the relationship between technique and theory can be vague (Marcus et al., 2006). A PA intervention systematic review (Foster et al., 2005), for example, noted that the heterogeneity of intervention research rendered it difficult to draw any firm conclusions about the precise components that were effective in leveraging PA.

It has been argued that theoretically informed interventions have a higher degree of success compared to those which are atheoretical (Abraham, Sheeran, & Johnston, 1998; Improved Clinical Effectiveness through Behavioural Research Group (ICEBeRG), 2006; Marcus et al., 2006). Using health psychology theory to inform interventions by attempting to isolate the predictors of behaviour and using techniques to address these predictors is a robust approach to intervention research (Michie & Abraham, 2004). It allows the intervention to be examined in direct relation to the constructs as well as the specific behavioural targets and populations (Improved Clinical Effectiveness through Behavioural Research Group (ICEBeRG), 2006).

Similarly, theoretically informed interventions can contribute to meta-analyses which assist in signalling the explicit underlying mechanisms which are eliciting change (Michie and Abraham, 2004). Critically, the value of using theory

enables behavioural medicine research and practice to move forward, aggregating the evidence in order to give credence to the identification of effective mechanisms of change while also discarding less robust techniques (Marcus et al., 2006; Michie, Johnston, Francis, Hardeman, & Eccles, 2008).

Nevertheless, much research in PA interventions has been equivocal in its use of health psychology theory to inform interventions (Marcus et al., 2006; Greaves et al., 2011). Where theory is poorly defined, the mapping of intervention to theory can also be neglected, and this undermines the capacity to draw firm conclusions regarding the specific techniques that are effective in promulgating PA change (Michie, 2008). The oversight may in part be attributed to the ambiguity surrounding theoretical constructs as well as a confusion about which theory to select to inform and guide an intervention (Brug, Oenema, & Ferreira, 2005; Improved Clinical Effectiveness through Behavioural Research Group (ICEBeRG), 2006).

2.3 Theory of Planned Behaviour and Physical Activity Intervention Research

The Theory of Planned Behaviour (TPB) (Ajzen, 1991) has been commended as being capable of being used as a '*core model of motivation'* (Abraham et al., 1998, p578) and consequently is instrumental in a body of intervention research (Armitage, 2005, Hardeman et al., 2002; White et al., 2012). According to Ajzen (1991), intention to engage in a behaviour is best predicted by a tripartite structure consisting of the attitude towards the behaviour, subjective norms, in conjunction with perceived behavioural control (PBC). PBC represents the control cognitions, the extent to which the individual believes that they have control over both internal and external variables that may impede undertaking the behaviour alongside a belief about confidence to undertake the behaviour in question (Ajzen, 1991). PBC influences intention but also influences behaviour directly (Conner & Armitage, 1998).

In addition to the influence of PBC, intention is also formulated on the basis of the attitude towards the behaviour (which encompasses the anticipated consequences of that behaviour as well as the evaluation of those anticipated consequences) and which reflects both an affect and cognitive component (French et al., 2005). Subjective norms completes the trilogy of influences on

intention and represents the beliefs that the individual holds about how others view the behaviour, but the views of others will be pertinent only if the individual holds these others in sufficient esteem (Marttila & Nupponen, 2000).

Research using the TPB in PA studies has illustrated its capacity to predict intention at moderate effect sizes (Amireault, Godin, Vohl, & Perusse, 2008; Hagger, Chatzisarantis, & Biddle, 2002). For example, a study testing the TPB in a sample of African American children, found that subjective norm and control acted as mediators between attitude and intention though prediction of behaviour was not significant (Martin et al., 2005). In a subsequent examination of the theory tested in a population of Mexican American children similar results were observed, illustrating in both studies the strength of the TPB to predict intention (Martin, Oliver, & McCaughtry, 2007).

The TPB been used to inform interventions less frequently than its use in studies to predict behaviour (Hardeman et al., 2002). In a PA study where the TPB was used in this capacity, researchers compared a TPB brief advice leaflet with a TPB intervention (Hardeman, Kinmonth, & Michie, 2009). Despite no significant change in behaviour, stronger intentions were predicted by affective attitude and PBC. The authors (Hardeman et al., 2009) attributed the lack of effect of the programme on behaviour in part, to a potential inconsistency of delivery due to a wide number of health practitioners who were delivering the programme which may have compromised the fidelity. In addition, the sedentary nature of the participants may also have been a factor, whereby there may have been greater resistance to change. However, the results are not entirely unique in the TPB PA literature where consistently greater observed change in intentions with more limited effect on behaviour, are reported (Hagger et al., 2002).

Systematic reviews and meta-analyses have similarly demonstrated the TPB's value in predicting behavioural intention and behaviour with similar proportions as demonstrated above (Armitage & Conner, 2001; McEachan, Conner, Taylor, & Lawton, 2011). A review of health behaviour found behavioural intention accounted for 41% variance, with prediction of behaviour slightly lower, at 34% (Godin & Kok, 1996). More conservative results at 39% and 27% prediction for intention and behaviour respectively were found in a review of TPB across a breadth of behaviours not limited to health (Armitage & Connor, 2001). The

authors maintain that the smaller variances emerged as they had restricted analysis to published studies only, and due to the broader scope of the behavioural focus beyond health (Armitage & Conner, 2001).

Not restricting a TPB review and analysis to health behaviours has both advantages and disadvantages. Although it is valuable to examine the theory irrespective of context and the core constructs have been recommended as 'generic' (Abraham, et al., 1998, p578), the TPB may operate uniquely in different behavioural domains (McEachan et al., 2011) and this is likely to account for some of the disparate proportions of variance recorded in the two reviews (Armitage & Conner, 2001; Godin & Kok, 1996). In a subsequent meta-analysis for example, McEachan et al. (2011) found that the TPB was superior in predicting PA and dieting behaviour and intention, but much weaker in the behavioural area of abstinence from drug use and detection predictions. This picture is made somewhat more complex by the characteristics of those participating in the inherent interventions; a younger population was represented in the drug use studies comparatively to some of the other studies. The TPB may be less effective in predicting behaviours of young people who have less routine in their lives (Amireault et al., 2008). What was not examined in this review, is the nature of the intervention nor techniques used, and this deeper level of analysis may be important to ensure that the intervention techniques are suitability matched with theory (Michie et al., 2008).

A critical distinction between the meta-analysis of the TPB by McEachan et al (2011) from that of the earlier reviews (Armitage & Conner, 2001; Godin and Kok, 1996) was an examination of the influence of past behaviour in the former review. The authors concluded that past behaviour attenuated behaviour, and in most behavioural domains was a stronger predictor of behaviour than intention (McEachan et al., 2011). Given the strength of the TPB to predict intention but with more limited efficacy in predicting behaviour, the influence of past behaviour may be particularly important in explaining the gap between intention and behaviour. While an individual may have positive intentions, the powerful pull of habit, may impede behavioural engagement, which will be discussed in further detail in the following section (Armitage & Conner, 2001).

The overall conclusions from this body of research is that while the TPB has been shown as capable of predicting PA intention with reasonable variance accounted for, the prediction of behaviour has consistently been much weaker (Armitage, 2005; Hagger et al., 2002; Martin, et al., 2007; Sniehotta, Gorski & Araujo-Soares, 2010). Altogether, this demonstrates that augmentation of the model is advisable to extend its predictive capacity towards behaviour and that past behaviour may be an appropriate factor to mitigate in order to increase the predictability of behaviour change (McEachan et al., 2011).

2.4 Extending the Theory of Planned Behaviour: Intention behaviour Gap

Past behaviour is often held responsible for attenuating behavioural change, disrupting the link between intention and behaviour (Armitage, 2005; McEachan et al., 2011). It has been repeatedly isolated in PA and other behavioural research as a predictor of future behaviour (Godin, 1993; Hagger et al., 2002; P. Norman & Conner, 2006; Rhodes & Courneya, 2004). The gap between positive intentions and behavioural outcomes can therefore in part be attributed to the powerful influence of how an individual has previously performed (Armitage & Conner, 2001). Past behaviour, it has been argued, is repeated because it relies on an automatic response which is often triggered by environmental or physiological triggers; a cue–response relationship (Bandura, 1998; Orbell & Verplanken, 2010). Indeed, it is argued that past behaviour may represent a heuristic required for decision making (Abraham et al., 1998) whereby individuals may behave with a degree of automaticity based on previous behaviour in order to minimise the information required for decision making, as well as the concomitant cognitive effort (Hagger et al., 2002). Bagozzi (1981) contended that past behaviour, based in part on frequency of occurrence, may be a learned behaviour which obviates any requirement to think about an alternative response.

Using a novel form of analysis to determine the attenuating influence of past behaviour, Armitage (2005) tested the uniformity of attendance at a gym. Non-uniformity would be expected if attendance was based on past behaviour which was confirmed in this study. Past behaviour provided mastery experience (Bandura, 1994) which predicted higher levels of PBC and significantly predicted gym attendance over 5 weeks of the study. The participants in Armitage's

(2005) study were current attendees at a fee-paying gym and therefore, the incentive nature of having paid a membership fee cannot be disregarded and may have compromised the results (Finkelstein et al., 2013; Higgins & Scholer, 2009).

Measuring behaviour before an intervention in order to accurately reflect behavioural change with respect to an intervention, is important in intervention research protocol and will be implemented in this study. However, it will also be necessary to compensate for the intention-behaviour gap in a manner which concurrently addresses the influence of past behaviour. One increasingly common approach has been to add a volitional component to the TPB, consisting of a planning technique (F. F. Sniehotta, Scholz, & Schwarzer, 2006; Sniehotta, Scholz, & Schwarzer, 2005).

2.4.1. Action Planning: Implementation Intentions

Planning according to (Gollwitzer & Sheeran, 2006), can overcome usual modes of behaving (Conner & Armitage, 1998; Luszczynska, 2006). The premise of planning is that if-then plans help to integrate the planned behaviour into the behavioural repertoire (Gollwitzer & Sheeran, 2006).

Identifying precise goals and specifying plans to navigate towards those goals (Bandura, 2001), have been referred to as implementation intentions (Gollwitzer & Sheeran, 2006). Gollwitzer (1999) predicated the concept of implementation intentions on the notion that goals are often not achieved because they can simply be intentions with little conviction. Translating these intentions into very specific targets with clearly set plans of how the action will be undertaken, how much, and at what time, will help to mitigate any oppositional forces deterring action (Gollwitzer, 1999). Gollwitzer (1999) proposed that situational cues help to trigger the action and introduce a level of automaticity to the intended behaviour. 'Implementation intentions are also said (Gollwitzer, 1993, 1996) to benefit action initiation through processes of automatization in the sense that action initiation becomes immediate, efficient and does not require conscious intent' (p498). Such is the strength of the implementation intention plan that it has been credited with being able to establish a trigger for the target behaviour and override the powerful impact of past behaviour (Orbell & Verplanken, 2010;

Riet, Sijtsema, Dagevos, & De Bruijn, 2011). Planning can bridge the intention behaviour gap and concurrently mitigate past behaviour with planned outcomes (Abraham et al., 1998; De Ridder & De Wit, 2006; F. F. Sniehotta, 2009).

Introducing a planning or volitional stage has achieved promising results in PA intervention research (Sniehotta et al., 2005). Luszczynska (2006) employed implementation intentions as an intervention for patients who had recently had a myocardial infarction, to engage in a PA programme compared to the control group who would participate in a PA programme alone. The creation of implementation intentions over and above usual care resulted in significantly greater levels of PA. The positive outcomes with clinical populations have also been observed in healthy volunteers (Hall, Zehr, Ng, & Zanna, 2012; Prestwich, Perugini, & Hurling, 2009) with similar small to medium effects, suggesting that the use of implementation intentions through action planning, would be a useful intervention adjunct to a TPB intervention in this study.

The addition of coping planning, argued by some, can produce more enduring and robust results than simple action planning mechanisms alone (Ziegelmann, Lippke, & Schwarzer, 2006). Coping planning is the prediction and planning for anticipated barriers and establishing pre-emptive strategies for how these will be resolved in order to achieve the behavioural target (Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008).

Sniehotta et al. (2006) maintain that incorporating coping plans enables the specification of anticipated risks which are partially based on an individual's habitual manner of responding to particular cues. The addition of coping planning to action planning it is argued, works 'synergistically' (Araujo-Soares, McIntyre, & Sniehotta, 2009) and while not specifically goal related, coping plans work in concert with action plans establishing a 'road map to action' (Sniehotta et al., 2006, p 26).

In a study comparing the efficacy of action planning or coping planning or combined action and coping planning with patients who were recently discharged from cardiac rehabilitation at hospital, those in the combined group undertook significantly greater levels of PA at hospital at 2 months (Sniehotta et al., 2006). These results have been demonstrated with a clinical sample, for

whom as noted above, the reasons for complying with the instructions of their practitioners may be more powerful. Nevertheless, effective results have been observed in general populations where PA action and coping plan intervention research has been undertaken (Kwasnicka, Presseau, White, & Sniehotta, 2013; Ziegelmann et al., 2006).

Planning has not consistently led to effective behavioural change (Skår, Sniehotta, Molloy, Prestwich, & Araújo-Soares, 2011), and this may be for a number of reasons including the manner in which the coping plans are evaluated, which is discussed in more detail below, as well as adherence to instructions (Kwasnicka et al., 2013). But in particular, planning used without any other intervention component appears to be insufficient to facilitate behavioural change (French, Stevenson, & Michie, 2012; Scott, Eves, French, & Hoppé, 2007).

2.4.2 TPB and Planning

When a planning component has been added to the TPB in PA research, behavioural change has been observed (Conner & Armitage, 1998; Presseau, Sniehotta, Francis, & Gebhardt, 2010; White et al., 2012). Adding coping planning alongside action planning to extend the TPB, has been shown to increase the likelihood of goals being reached (Arbour-Nicitopoulos, Ginis, & Latimer, 2009). Sniehotta, Gorski, and Araújo-Soares (2010) compared an extended TPB incorporating planning, with the common sense model (Leventhal, Brissette, & Leventhal, 2003) in a PA intervention study. The extended TPB emerged as far superior in predicting behaviour (Sniehotta et al., 2010). Although results were promising and indicate the value of adding planning to the TPB, the number who had recorded that they had written plans was limited; 38.9 % of the sample (Sniehotta et al., 2010). It could also be argued that a clinical population may have more compelling reasons to pursue behavioural change, motivated perhaps by a need to get well and with more salient beliefs about the risks to life (Hardeman, Michie, Kinmonth, Sutton, & ProActive project team, 2011). In a general population, adherence may be even more conservative.

The extended TPB similarly led to positive PA outcomes in subsequent studies (French, Stevenson, & Michie, 2010; White et al., 2012). In a waiting list control study with a general population (Darker, French, Eves, & Sniehotta, 2010) techniques to increase PBC and walking were employed alongside techniques to form action and coping plans for the purpose of providing both motivational and volitional input. Both walking and PBC were shown to have increased and the behavioural change was mediated by PBC. The intervention was delivered directly by the intervention designer and researcher and it is possible that there may have been some unintentional influence in how the intervention was delivered (French et al., 2012).

A subsequent replication of the Darker et al. (2010) study used intervention deliverers who were not associated with the study, and separated conditions of motivation from that of volitional, and also tested these in combination (French et al., 2012). Positive walking results were observed only when both groups of techniques were used, suggesting that these techniques can be effective in increasing walking (French et al., 2012). This latter study used a sample size of only 35 distributed to intervention and control conditions, and hence, would need to be replicated with a larger sample to establish suitable power.

The effectiveness of volitional and motivational techniques through an extended TPB model suggests that these techniques can be replicated with similar positive outcomes. They will be adopted for the current study, though the application will be extended to all PA, and further adaptations will be made regarding delivery of intervention and measurement. These issues are discussed in further detail later in this chapter.

2.5 Measurement of Action and Coping Plans

It is evident that in much of the action and coping plan literature it is customary to record planning outcomes by measuring whether plans have been made either by a simple yes or no (Sniehotta et al., 2005), by using the Action Plan, Coping Plan measure (APCPS) (Araujo-Soares et al., 2009b) or other similar measures (Luszczynska, 2006). These methods record that plans (action and coping) have been made, but do not record the content of the plans (Araujo-Soares et al., 2009b).

This simple, often dichotomous measurement, may be important to determine that plans exist, but provides no indication of what the participant has opted to undertake. Importantly, small incremental behavioural changes may have more chance of success (G. J. Norman et al., 2007). Nonetheless, these changes may not be detected as statistically significant, and hence mask that participants are achieving self-set targets. Establishing the targets individuals set, and the relationship with behavioural outcomes, may provide evidence of limited, but incremental change.

It is therefore prudent, that examination of the plans is undertaken in this study, to establish if a relationship exists between the goals set by participants, and the recorded behavioural outcomes. This will enable the research to determine whether the specific ambitions outlined in plans have been achieved.

2.6 Perceived Behavioural control and self-efficacy

As discussed above, the weakness of the TPB in accounting for past behaviour can be compensated for by the use of action and coping plans. Another challenge in using the TPB in intervention research, has been an obscurity which appears to exist around the terms 'self-efficacy' (SE) and 'perceived behavioural control'. A consistent message from previous PA TPB research is that PBC often emerges as the strongest determinant of intention (Armitage, 2005; Hagger et al., 2002), nevertheless, the literature is not always clear about the distinctions between SE and PBC (Ajzen 1991; Hardeman et al., 2002).

Self-efficacy, Bandura claimed (1991), refers to the capacity or competency an individual feels in undertaking a behaviour under a range of circumstances. Ajzen (1991) originally contended that PBC was roughly equated to SE (1991). A perceived overlap in the concepts has led to them being used synonymously (Kraft, Rise, Sutton, & Røysamb, 2005; Tavousi et al., 2009; Trafimow, Sheeran, Conner, & Finlay, 2002).

In a review by Hagger et al. (2002) comparing the efficacy of the TPB versus the TRA in predicting PA behaviour, the authors contended that SE is the internal construct reflecting personal agency and is a better predictor of intention, while external control is embedded in PBC and is the better predictor of behaviour, a concept originally presented by Terry and O'Leary (1995). This conclusion has

found favour in other literature (Tavousi et al., 2009; Trafimow et al., 2002). The criteria for distinguishing PBC and SE, however, were based on definitions within each of the inherent studies. These criteria Hagger and his associates (2002) had noted as being problematic because 'most authors tend to confound the two aspects of control by including items measuring internal and external aspects in a single scale' (p. 22).

Basing analysis on the descriptions inherent in the studies therefore, creates the risk that the results may continue to confound constructs of control rather than to distinguish them. By contrast Armitage and Conner (2001) in their review and meta-analysis of the TPB, distinguished between the concepts of SE, perceived control, and PBC, on the basis of questions used to measure the domains rather than by the inherent terms used in the studies. They isolated SE by statements such as, 'if it were entirely up to me, I am confident I can'; perceived control by statements 'whether or not I do X is entirely up to me', and mixed measures of the two were defined as PBC. They found that PBC and SE predicted intention and behaviour with similar levels of variance and could find no argument to suggest that one or other variable was superior (2001).

Where PBC and SE have been used in TPB PA intervention research, the lack of distinction often persists (Hardeman et al, 2002). For example, in a study designed to increase walking and PBC, it used SE enhancing techniques to do so, though the measurement of PBC relied on the recommendations of Ajzen (2002) assessing SE and controllability. Despite the lack of clarity about the variables, the conclusion drawn from the results was that increasing SE can lead to an increase in PBC and walking (Darker et al., 2010).

Given that the descriptions of SE, PBC and perceived control have repeatedly been used synonymously, as well as the interchange-ability of instruments used to measure each of these variables, it is difficult for any researcher to have confidence that the measurement of these constructs is accurate and the results of studies necessarily robust (Armitage & Conner, 2001; Pertl et al., 2010). A conclusion that can be drawn from the literature is that the constructs of confidence, control and ease are unique (Pertl et al., 2010); though, it also appears as if they can operate in very similar fashions (Darker et al., 2010;

Hagger et al., 2002). The variance accounted for by each of the variables is often, nearly equitable (Armitage & Conner, 2001).

In the TPB questionnaire construction guidelines issued by Francis et al. (2004), the authors recommend that PBC should be measured using both control cognitions and confidence, which adheres to Ajzen's (2002) contention that these should be aggregated. This parsimonious treatment of the variables has found considerable support in subsequent PA intervention research (Araújo-Soares, McIntyre, MacLennan, & Sniehotta, 2009; Armitage, 2005) and is consistent with the pragmatic approach described earlier (Darker et al., 2010). Hence in this study, measurement of PBC will be deployed as per guidelines (Francis et al., 2004) and consistent with the extant constructs of the TPB (Ajzen, 1991).

2.7 Key points emerging from PA evidence

The accumulated PA evidence illustrates several points:

- Firstly, the TPB has demonstrated its capacity as a theory of the predictors of PA intention, but predicts PA behaviour with more moderate effect sizes (Armitage, 2005; Hagger et al, 2002; Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2010).
- Secondly, that there exists an intention-behaviour gap whereby intentions to act, reliably predicted by the TPB, do not necessarily correspond to actual behaviour (Hagger et al., 2002; Sniehotta et al., 2006).
- Thirdly, that PBC often dominates the theoretical constructs of the TPB in predicting intention and, to a lesser degree, behaviour (Hagger, Chatzisarantis, & Biddle, 2001; Hagger et al., 2002; P. Norman, Conner, & Bell, 2000; Rhodes, Macdonald, & McKay, 2006).
- It is apparent that PBC and SE operate in very similar fashions and techniques used to increase SE have produced effective increases in PBC.
- Past behaviour, where this has been measured (and Ajzen (2002) recommends that it should be) has an attenuating influence on the predictive capacity of the TPB variables including PBC (e.g. Araujo-

Soares, et al., 2009; Armitage & Conner, 2001) rendering the theory more effective as a motivation model rather than a model of change.

- Action and coping plans have been instrumental in bridging the intention behaviour gap and simultaneously mitigating past behaviour (Armitage & Conner 2001; Gerber, Mallett, & Pühse, 2011; Sniehotta et al., 2006) and hence are a valuable asset to behavioural change interventions.
- Action and coping plan research has focused on recording the existence of action plans using simple, largely dichotomous measures (Araujo-Soares et al., 2009; Skår et al., 2011). This recording procedure may fail to capture more conservative behavioural changes which nevertheless demonstrate a relationship with personal intentions.

Based on these conclusions from the TPB PA literature, it is therefore salutary that in constructing an effective intervention to increase PA, the intervention should include techniques to increase PA PBC (Darker et al., 2010; French et al., 2012; Hagger et al., 2002). Mechanisms to minimise the impact of past behaviour, and bridge the intention-behaviour gap which would consist of action and coping planning techniques are consistent with the literature (e.g. Armitage, 2005; French et al., 2012) should also be incorporated. Measuring cognitive change, should also be undertaken to establish if the inherent constructs of the TPB are operating in the manner predicted by the theory and in order to test whether the techniques are being effective in precipitating cognitive change. Similarly, recording the plans, and examining the goals and behavioural outcomes achieved, should also be included in this study in order to determine the relationship.

Important considerations are, nevertheless, outstanding: what techniques should be used to address the constructs of action and coping planning and PBC, and the manner in which these should be delivered. The subsequent chapter therefore, will examine effective delivery mechanisms that can ascertain that fidelity to the intervention techniques can be maintained as urged by earlier literature (Hardeman et al., 2009).

Chapter 3: Intervention Development and Delivery Mode

3.1 Intervention content

The previous chapter discussed the value of including techniques to increase PBC alongside action and coping plans for a PA intervention having previously shown promising results (Darker et al., 2010; French et al., 2012).

3.2 Intervention structure and techniques

Health behaviour intervention research has been criticised for neglecting to provide sufficient detail of interventions to allow for replication and for subsequent meta-analysis (Brug et al., 2005; Michie, 2008). Without this information it minimises the opportunity to amass to indicate which techniques are most effective in changing specific behaviours (Michie & Abraham, 2004). The following sections discuss the rationale for the techniques used, and the style of delivery in order to ensure sufficient transparency for future replication in line with intervention mapping guidelines (Craig et al., 2008; Kok, Schaalma, Ruiter, van Empelen, & Brug, 2004).

3.2.1 Techniques to increase Physical Activity Perceived Behavioural Control

Ajzen has not been clear about how to operationalise the TPB, nor constructs therein (Darker et al, 2010); he and Fishbein (Ajzen & Fishbein, 1980) did propose that persuasive techniques can be employed to change cognitions. There is limited evidence, however, that validates this view (Hardeman et al., 2002).

Bandura (1994) recorded four main sources of information that can enhance SE. Mastery experiences refer to the capacity for an individual to feel competent in an activity because they have previously been successful in pursuing the activity; vicarious experience is the knowledge gained from observing others similar to oneself achieve similar goals; social persuasion is gentle encouragement suggesting that the individual has the capacity to succeed with suitable effort and guidance (Bandura, 1998). Reducing dissonant beliefs about the negative outcomes of the target behaviour is the final technique for

enhancing SE (Bandura, 1998). Bandura (2005) proposed that the use of mastery experiences is the most powerful technique to enhance SE.

In a study referred to earlier (Darker et al., 2010) employing an extended model of the TPB to promote walking, PBC and intention to walk, SE enhancing techniques in line with Bandura's recommendations were used to increase both PBC and SE. The decision to use the same techniques to increase both SE and PBC, was made on the basis of the proximity of the cognitions of PBC and SE. (Darker et al., 2010), which has been voiced by others (e.g. Hardeman et al., 2002). These were delivered in a manner compatible with motivational interviewing (MI) whereby reasons to change have the most potency when they are voiced by the individual (Miller & Rollnick, 2004). The study was a waiting list randomly controlled trial (RCT) and results showed increased attitudes, PBC and intentions to walk, as well as walking, and increases in intention and behaviour were mediated by PBC (Darker et al., 2010). As previously noted, these results may have been influenced by the delivery of the intervention by the researcher. This underscores the need in this study to use a more standardised delivery to minimise this risk which will be discussed in more detail, nevertheless, the results suggest that the techniques can be effective in increasing PBC and walking.

The efficacy of using SE enhancing techniques to increase behaviour and self-efficacy (Darker et al., 2010) are in accordance with other health behaviour intervention literature (Ashford, Edmunds, & French, 2010; Darker et al., 2010; S. L. Williams & French, 2011). Drawing on evidence from earlier face to face studies (e.g. Darker et al., 2010; French et al., 2012; White et al., 2012), the intervention in this study will employ similar techniques of vicarious experience, mastery techniques and visualisation in order to enhance PBC. The delivery will draw on the motivational interviewing conversational framework (Rollnick, Miller, & Butler, 2008), again, in line with earlier studies (Darker et al., 2010; French et al., 2012). TPB measurement here, will include the construct of PBC, rather than SE as undertaken previously (French et al., 2012) in order to remain consistent with the TPB theory.

3.2.2 Techniques for Planning: Action and Coping

Action and coping planning have previously been reported to operate symbiotically to increase PBC (Araujo-Soares et al., 2009) while simultaneously bridging the intention-behaviour gap (Sniehotta et al., 2006). Techniques such as prompting, self-monitoring, goal-setting, reviewing of goals, visualisation and use of imagery have been instrumental in both increasing PBC and planning for anticipated outcomes, while mitigating previous behavioural habits (e.g. Sniehotta et al., 2005; White et al., 2012). Previous literature points to these techniques as producing large effect size changes in PA intervention studies (Bird et al., 2013; Greaves et al., 2011).

In contrast to some of the earlier studies using motivational and volitional components (Darker et al., 2010) the intervention will also consist of review and feedback techniques provided in a successive week. This is in accordance with the literature whereby feedback and review are important to enable individuals to establish how well they have performed against targets and to modify behaviour as appropriate (Lubans, Morgan, Callister, & Collins, 2009; S. Williams, Knowlden, & Sharma, 2012).

3.3 Taxonomy of Behavioural Change Techniques

Given the diverse definitions used for techniques, aggregation of research evidence can be compromised (Abraham & Michie, 2008). In order to respond to these challenges, and to establish a more formulaic selection and application of techniques and a coherent catalogue of definitions, Abraham and Michie developed a health behaviour change taxonomy (2008). The taxonomy lists health behaviour change techniques (BCT's); it facilitates replication of interventions and hence more robust research evidence which is of considerable value to implementation science (Craig et al., 2008). Previous systematic reviews have found the taxonomy valuable in isolating effective techniques in specific behavioural domains (Bird et al., 2013; Dombrowski et al., 2012; Gainforth et al., 2011; Michie et al., 2009). Though while useful for intervention development and systematic review, it is apparent that the taxonomy is not exhaustive and will require future review to incorporate techniques currently identified in the literature but not present in the taxonomy (Bird et al., 2013;

Dombrowski et al., 2010). A refined taxonomy for the specific analysis of BCT's used in obesity and PA interventions was being developed at the time of this current study, but was not available for use (Michie et al., 2011).

The techniques selected for this study and which have been discussed previously in relation to increasing PBC, are listed against the taxonomy and can be seen in appendix 1, with a corresponding check mark to indicate its use in this study and the week in which the technique was delivered.

3.4 Delivering a Physical Activity Intervention – How and by Whom

What remains to be addressed is how the intervention will be delivered and by whom. These questions reflect a previously voiced concern regarding the consistency of behavioural change intervention delivery, given that manuals are often not sufficiently detailed in research protocols, or that there may be insufficient fidelity checks (Gardner et al., 2010; Knight, McGowan, Dickens, & Bundy, 2006). A lack of fidelity to intervention protocols can undermine research conclusions and undermines evidence based intervention use (Abraham et al., 2009; Greaves et al., 2011; Hardeman et al., 2002; Michie, Fixsen, Grimshaw, & Eccles, 2009).

In addition to concerns over consistency of delivery are questions over the scrutiny that is applied to the manner in which the intervention is delivered and who is delivering it and the influences that this may have on the results (Abraham et al., 2009; Greaves et al, 2011). There appears to be limited attention to this form of scrutiny in the literature.

The following sections discuss digital delivery as a means of addressing transparency and consistency of intervention delivery. They explore the literature on practitioner versus self-administered interventions using digital technology.

3.4.1 PA Intervention Delivery: the HOW: Digital

One of the requirements of a gold standard intervention is that it can be rolled out in a widespread campaign with limited financial and human resources (Glasgow, Bull, Gillette, Klesges, & Dzewaltowski, 2002) which strengthens the case to consider delivery through the use of technology.

Technology reach is broadening rapidly and in Scotland, internet use in 2011 moved from 70 % to 74 % in only one year (Scottish Household Survey, 2011). The Scottish Household Survey (2011) recorded that internet access through broadband connection was 'regardless of level of deprivation or rurality' (2011, p75) illustrating the capacity of reach to households across the socio-economic spectrum.

Using a digital delivery system can be a suitable means of delivering PA interventions as it provides convenience for participants (D. M. Williams et al., 2008) circumventing challenges of accessibility posed by remote and rural environments or mobility problems (Aalbers, Baars, & Rikkert, 2011). Using the internet can enable the intervention to be standardised and open to scrutiny which can address criticisms about lack of fidelity to the intervention, and insufficiently detailed manuals (Greaves et al, 2011; Marcus et al, 2006). Digital interventions can also provide clarity, consistency and transparency which can facilitate replication and widespread expansion of interventions (Collins et al., 2010; Morgan et al., 2013; Patrick & Canevello, 2011). Therefore, to address calls for the intervention to be deployed as effectively (Kok et al., 2004), stringently (Bennett & Glasgow, 2009; Glasgow, Klesges, Dzewaltowski, Bull, & Estabrooks, 2004) and consistently (Neville, O'Hara, & Milat, 2009; Riemsma et al., 2002) as possible, the techniques will be developed into an online module delivery format.

In order to ensure that the intervention development was not replicating previous research but rather building on existing knowledge, an examination of literature was undertaken. The search examined internet delivery of PA interventions incorporating techniques of increasing PBC and PA and action and coping planning techniques in PubMed and EbscoHost. The search terms used are presented in Table 3.1.

Limiters: 1995 – April 2011

Table 3.1 Literature Search Terms

Outcome	Intervention/Outcome	Intervention/Outcome	Delivery Method
Physical activity	Perceived behav* Control	Plan*	Internet
Walk*	Self-efficacy	Action plan*	Digital
Exercise		Coping plan*	Technolog*

Despite the extensive use of technology to deliver interventions, a search of the literature revealed that there is limited evidence of theoretically informed digitally delivered interventions specifically employing techniques to enhance PBC or SE and which also include, action planning and coping planning in PA, exercise and/or walking. Indeed, only one study (Skår et al., 2011), emerged from the search which included all three elements. Skår and colleagues (2011) delivered a 2 x 2 factorial designed action and coping planning PA intervention study. No significant increase in activity was observed. Measures of TPB cognitions did not find any significant change between pre and post-test measures. What is evident however is that technology was used only to email participants information about the value of making action /and or action and coping plans. There were no motivational techniques used, and previous evidence suggests that volitional techniques on their own are insufficient to broker behavioural or PBC change (French et al., 2012; Scott et al., 2007).

Based on this paucity of research attention, this present study will address the gap by delivering an internet based intervention designed to implement action and coping plans alongside techniques to increase PA PBC and PA.

3.4.2 PA Intervention Delivery: the WHOM:

Health behaviour change internet intervention studies are often vague about specifying the level or type of practitioner support (Webb et al., 2010). Where analysis of self-administered or practitioner support in online interventions are concerned, comparisons between F2F versus online (Steele, Mummery, & Dwyer, 2007) are more common than comparisons between support and no support.

In a systematic review of internet based PA interventions (van den Berg, Schoones, & Vliet Vlieland, 2007) four studies were identified which attempted to

isolate the influence of the dose of practitioner contact (the number of contacts with the practitioner) on PA outcomes, where the practitioner support was fully online largely through email. In three of these studies no significant differences in PA between conditions was detected. However, often the comparison was between email content which was personalised and tailored and hence dose was not being isolated in these studies, but rather the impact of personalised, tailored messages (Van den Berg et al., 2007). In one study, the comparison was not exclusively between support and non-support as the intervention group also received opportunities for F2F meetings as well as tailored guidance on PA and an ergometer (Van den Berg et al., 2007).

The lack of clarity therefore regarding whether a web based intervention should be self-administered or have the support of a practitioner, establishes the need for this study to compare practitioner support versus no support, to determine if it is required to increase PA in an online intervention. Email will be used which has less variability than other asynchronous or synchronous online communication systems (Mohr, Cuijpers, & Lehman, 2011). This will enable standardised contact and will not include tailored information, which may have an influence in addition to the support offered.

Practitioner support therefore, in this study, is construed as providing supportive emails once a week for each of the 2 weeks of the intervention. The content of the emails will draw on MI principles of encouragement and personal choice (Rollnick et al., 2008). The emails will include techniques as listed in the above taxonomy and discussed earlier as instrumental in increasing PA PBC or action and coping planning (Darker et al., 2010; French et al., 2012; Sniehotta et al., 2006).

3.5 Summary of Intervention theory, technique, delivery and deliverer

Based on evidence and guidance examined above, the pragmatic approach to develop an intervention will be to isolate the constructs influencing PA and to operationalise those techniques which may be effective in changing those influences. The following points summarise key aspects that need to be considered to operationalise in a PA online intervention.

1. The constructs of previous behaviour and PBC emerge as those most predictive of behaviour and hence most suitable for targeting in an intervention.
2. Action and Coping Plans help to embed the motivation for behaviour change inspired by PBC and goal setting to establish a volitional change.
3. Action and coping plans should be examined to establish the relationship between goals and behavioural outcomes.
4. The intervention should be delivered through the internet in order to achieve a high degree of consistency, transparency and hence fidelity to the protocol.
5. This study should seek to compare the condition of practitioner support through email contact, to a condition of self-administered.

3.6 Aim and Hypotheses of Current Study

The focus of the current study is to deliver an interactive internet PA intervention. In accordance with previous literature, the focus of the delivery of the intervention will be to enhance PA PBC and address past behaviour. Increasing levels of PBC, using SE enhancing techniques, are construed as being predictive of leading to increased levels of intention to engage in PA (S. L. Williams & French, 2011) Addressing the intention behaviour gap will be established through instructing participants to create action and coping plans to translate intention into behaviour.

The current study will harness the use of the internet to deliver the intervention. This will address previous criticisms about fidelity to research protocol as the delivery would be transparent and consistently delivered. Practitioner support versus self-administration will be examined by providing either weekly email contact or no contact.

As noted above, the TPB presents a robust model to examine any change in the cognitions towards the target behaviour and can be used to explain and predict the determinants of PA change.

3.6.1 Aim

The aim of the study is to examine an online intervention which will be devised using techniques to enhance PA PBC alongside techniques to lead to the development of PA action and coping plans and finally to establish the influence of practitioner support in an online intervention.

3.6.2 Hypotheses

This study will seek to examine the following hypotheses on intervention efficacy and a research question on acceptability:

1. The intervention (techniques to increase PBC and action and coping plans) will lead to increased levels of PBC.
2. The intervention will lead to increased levels of PA measured through pedometers and self-completed dairies
3. The intervention and practitioner support will lead to increased levels of PA over and above that achieved by those in receipt of practitioner support or intervention only
4. Those who set targets will achieve targets set.
5. Walking and PA for those in the control group will remain unchanged.

Acceptability of the intervention will be examined by exploring views on:

1. What is the acceptability of the use of the internet intervention and what improvements can render it more acceptable?

Chapter 4: Methods

This chapter discusses the methods used, and the rationale for their selection, to study the efficacy and acceptability of an online PA intervention, in a manner which meets the research aims and hypotheses.

4.1 Method Rationale

Despite some earlier research examining interventions to increase PA PBC (Araujo-Soares et al., 2009; Darker et al., 2010; French et al., 2012), the combination of increasing PA and PBC alongside introducing action and coping plans in a digital intervention does not appear to have previously been examined. As such this study sets out to examine both a novel area, alongside extending investigation into an area that has been investigated, and drawing these both together. Using mixed methods of research is a pragmatic approach when analysing two juxtaposing phenomena (Feilzer, 2010; Onwuegbuzie & Leech, 2004). However, using mixed methods continues to be a topic of some debate in health research given that qualitative methods and quantitative methods both emerge from different epistemological and ontological positions (Sale, Lohfeld, & Brazil, 2002).

A quantitative approach assumes a search for an answer (Creswell, Plano Clark, Gutmann, & Hanson, 2003), 'a conjectural' truth (p7), which could be revealed through robust scientific analysis. Post-positivism, whereby there is an assumed objective examination of a discrete set of variables to establish the existence of a relationship, is the accepted practice within the quantitative paradigm (Creswell et al., 2003).

Qualitative methods, by contrast, aim to explore and uncover perspectives on which little is known. The premise is that what will be revealed can either be used to interpret (as from the interpretivist perspective) the world, or that the knowledge can contribute to the construction of a social meaning of the world (Creswell et al., 2003).

Given what appears as polar perspectives of knowledge, there is an assumption that these two methods cannot be integrated (Sale et al., 2002). This view has been increasingly challenged, particularly within the area of

health psychology (Dures, Rumsey, Morris, & Gleeson, 2011; Sale et al., 2002). Dures et al. (2011) argue that a pragmatist paradigm which refers to knowledge that is gained from focusing on the problem rather than on specific methods that are employed, is immensely valuable. Methods then act as the servants of the research question and are irrespective of philosophical boundaries that may exist between, and divide, quantitative and qualitative ideologies.

An important principle of mixed methods is that the methods should work in an integrative or symbiotic fashion and critically that the researcher should pursue procedures whereby the purpose and justification are transparent (Creswell, 2003; Dures et al., 2011). In the context of examining health behaviours, this approach would seem to be appropriate given that health actions reflect a complex interplay between social and environmental contexts and individual, physiological, attitudinal and affective factors (Suls & Rothman, 2004). Taking a pragmatic approach by blending quantitative data with participant perceptions of 'the world' could perhaps provide a holistic perspective. This facilitates a deeper and more complete response to the research questions than a study that exploits either quantitative or qualitative methods alone (Sale et al., 2002).

There are several approaches to combining methods of which two common ones are completeness and triangulation (Robson, 2011). Triangulation (Campbell & Fiske, 1959) refers to combining data types which Jick (1979) recommends as a means to enrich and consolidate the results of a study. The value of triangulation is to enable data from different sources examining the same concept, to improve the accuracy of results and add to the robustness of the conclusions drawn from those results (Begley, 1996). Triangulation enables a corroboration of results (Seale, 1999). In this study, the additional understanding was to gather perspectives that would not necessarily corroborate results, but instead would provide a deeper understanding.

Completeness (Bryman, Becker, & Sempik, 2008) or 'Complementariness' (Hammersley, 2008) refers to combining methods in order to achieve a more coherent response to the research question/s. Using only quantitative methods could leave gaps in knowledge and understanding. There are many who see completeness as a type of triangulation rather than a method in its own right (Hammersley, 2008). Definitions aside, the essential rationale in this current

study for using mixed methods was the contention that combining the data could engender 'completeness' and a more robust understanding of the phenomena, namely the usefulness, acceptability and efficacy of the intervention.

The qualitative data primarily, though not exclusively, was used to assess acceptability, whereas the quantitative data mainly assessed the efficacy of the intervention. Understanding the acceptability of the tool assists in interpreting the efficacy of the tool and together the data enables a richer interpretation of the value of the tool to the prospective end user.

How the different methods relate to each other is also important to establish. Procedures can be sequential, concurrent or integrative (Creswell et al., 2003). In the current study qualitative and quantitative methods were used concurrently. The data from each aspect of the study allowed for fuller understanding of the results in an integrative manner.

4.2 Hypothesis testing

Hypothesis 1 (H1): The intervention (techniques to increase PBC and action and coping plans) will lead to increased levels of PBC.

TPB constructs were measured using a piloted PA TPB questionnaire consisting of Likert scale questions (G. Norman, 2010) (See Appendix 4 for the piloting of the questionnaire). The questionnaire also included questions pertaining to demographic information and current PA behaviour (See Appendix 5 for the PA TPB questionnaire).

Hypothesis 2 (H2): The intervention will lead to increased levels of PA measured through pedometers and self-completed diaries.

In order to test this hypothesis, measurement of PA was undertaken over a 4 week period. This included measuring both walking (pedometer recording) and PA (diary recording) to determine if the intervention was successful in increasing PA.

Hypothesis 3 (H3): The intervention and practitioner support will lead to increased levels of PA over and above that achieved by those in receipt of practitioner support or intervention only

PA measured using self-report and walking and compared using a 2 x 2 factorial design enabling comparison between intervention conditions and support conditions and an interaction effect.

Hypothesis 4 (H4): Those who set targets will achieve targets set.

Action and Coping Plan goals could be coded categorically with 'achieved' and 'not achieved' when compared with the behavioural outcomes recorded in the self-report diaries.

Hypothesis 5 (H5): Walking and PA for those in the control group will remain unchanged.

The control group did not receive practitioner support or intervention. Participants recorded self-report diary and pedometer data and submitted on a weekly basis. Access was to an online module shell, with instructions on how to submit diaries.

Acceptability

The study incorporated a research question to evaluate the acceptability of the intervention given that techniques were being piloted in an online format. It was therefore also appropriate to elicit views of acceptability of the intervention (R. Steele, Mummery, & Dwyer, 2007; Vandelanotte & De Bourdeaudhuij, 2003); and for this, both Likert style and open ended questions were used and are discussed in more detail below (see Appendix 5 for the full questionnaires used for pre-test, post-test and acceptability).

Table 4.1 Summary of Hypotheses Testing

	Hypotheses	Measures	Time of testing	Group/s collecting data
H1.	The intervention (techniques to increase PBC and action and coping plans) will lead to increased levels of PBC.	PA TPB validated questionnaire	Pre-test Post-test	All groups
H2.	The intervention will lead to increased levels of PA measured through pedometers and self-completed dairies	Pedometers Self-report PA diaries	Pre-test Week 1 Week 2 Post-test (week 3)	All groups
H3.	The intervention and practitioner support will lead to increased levels of PA over and above that achieved by those in receipt of practitioner support or intervention only	Pedometers Self-report PA diaries	Pre-test Week 1 Week 2 Post-test (week 3)	All groups
H4.	Those who set targets will achieve targets set.	PA action and coping plans Self-report PA diaries	Pre-test Post-test	Intervention group only
H5.	Walking and PA for those in the control group will remain unchanged.	Pedometers Self-report PA diaries	Pre-test Week 1 Week 2 Post-test (week 3)	All groups
	What is the acceptability of the internet intervention and what improvements would render it more acceptable?	Open questions (restricted to 450 characters) Likert questions	Post-test	Intervention groups

4.3 Ethical approval

Ethical approval was received from Queen Margaret University Ethics Committee and the Ethics Committee of the University of the Highlands and Islands.

A participant Information sheet (Appendix 2) was provided highlighting the participants' freedom to withdraw from the project at any point without penalty. Participants were advised that they did not need to answer any questions and could do so without submitting reason or justification.

Participants were identified by a unique participant number created by participants, using a simple system of inputting select information from postcode, maternal first name initial, and telephone number.

4.4 Study Design

A randomly allocated prospective trial incorporating a 2 x 2 factorial design was employed. The two factors consisted of 1) an online PA intervention and 2) Practitioner support. The study was conducted over four weeks including base line (pre-test) and post intervention (post-test). The intervention was delivered over a two week period in-between these two points.

4.5 Conditions

Participants were allocated to one of four conditions: Intervention (INT); Intervention plus Practitioner Support (INTSS); Practitioner Support (SS) or Control (C). All participants were enrolled on one of two websites and accessed these on four separate occasions over four weeks. (Though, they were permitted to access it as often as they liked over the four weeks). The intervention consisted of an online 'tool' designed to increase PA PBC and enable the construction of action and coping plans. Practitioner Support consisted of weekly motivationally designed emails. Non-intervention participants (**SS** and **C)** conditions accessed an online page where they could upload their PA diaries (C).

Table 4.2 2 x 2 design

	Practitioner support	No Practitioner support
Intervention	Intervention with practitioner support INTSS	Intervention/ no practitioner support INT
No Intervention	No intervention/ practitioner support SS	No intervention/ no practitioner support (Control group) C

4.5.1 Randomisation

Participants were randomly allocated using a random number generator (Darker et al., 2010). They were enrolled into the appropriate module and future dialogue was issued through the announcement feature which sent the 'supportive' messages to participants in the practitioner support environment.

4.5.2 Blinded-ness

Participants were blinded to the condition that they had been allocated to. Although the researcher could see the different conditions that participants were a part of, due to the limited communication between participants and researcher, there were no implicit messages or variable treatment that could confound the research based on condition allocation.

4.6 Procedure:

Once participants had signed up for the project they were randomly allocated to one of four conditions and enrolled on one of two modules – the intervention module or a module with information about how to access the diaries and how to submit these. During week zero (pre-test) all participants recorded PA through pedometers, submitted PA diaries, and completed the pre-test TPB questionnaire. In week one, for those in the intervention group, a module section was delivered which contained the intervention techniques. Those in the practitioner support condition received a supportive email. Those in the control and practitioner support only conditions had continued access to the diary submission information module only. Participants in the intervention condition were required to submit action and coping plans which included a specific PA behaviour they wished to increase. All participants in all conditions submitted diaries at the end of the week which included their PA activity and pedometer data. During week two participants received a supportive email for those who were in the support condition. For those in the intervention conditions, a review and generic feedback was issued through the week two module section. All participants submitted diaries at the end of the week. During week three, no intervention was delivered and all participants were asked to submit diaries and complete a post-test TPB questionnaire.

4.6.1 The intervention:

The intervention manual (titled the Health Action Planning (HAP) Tool), is provided in Appendix 3 and the techniques used are based on the evidence examined in chapters 1 – 3.

4.6.2 Intervention Delivery Technology

Using technology was adopted here in order to facilitate reach and accessibility of the intervention as well as to establish a consistent delivery.

The internet technology hosting platform of the delivery system was blackboard. The blackboard (BB) virtual learning environment (VLE) enables participants to read materials online.

A degree of interactivity was enabled which was incorporated into the intervention. Participants for example, were asked about their level of confidence in undertaking PA on a scale of 0 – 10 and were able to note their response directly onto the relevant learning page. An immediate response was returned which invited participants to examine their cognitions in relation to this question more deeply. The full manual is provided in Appendix 3.

Practitioner support was established through supportive emails delivered in weeks one and two. Reminder emails to submit diaries were also submitted each week, and these were distributed to all participants. A sample e-mail is provided in Appendix 6.

Table 4.3 Procedure by week and by condition

Week	***Activities***
Commencing 8 weeks prior to week 0	Recruitment and Allocation: Invitation to participate in study sent to all UHI staff and students Enrolling participants received: participant information sheet and consent and confidentiality form All participants issued with ▪ full TPB questionnaire ▪ pedometer ▪ physical activity diary All names of participants who completed initial questionnaire and started on programme were entered into prize draw for an IPAD 2
	Groups participants were randomly allocated to one of the four conditions:
	Intervention/no practitioner support (INT) | Intervention with practitioner support (INTSS) | practitioner Support Only (SS) | Control (C)
Week 0	Sent joining instructions through email including detailed instructions about how to access online (intervention) module | Sent joining instructions through email including detailed instructions about how to access online module (how to record and submit data)
	Record walking and PA each day for 5 out of 7 days
Week 1	Module Intervention week 1
	practitioner support email message
	Record walking and PA each day for 5 out of 7 days
	Submit Action and Coping Plans
Week 2	Module intervention Week 2
	Record walking and PA each day for 5 out of 7 days
	Review action plans and coping plans
	practitioner support email message
Week 3	Record walking and PA each day for 5 out of 7 days Full TPB questionnaire

Key: = not applicable for group

4.7: Participants

4.7.1 Recruitment

Adverts were sent through the University of the Highlands and Island's (UHI) virtual learning environment (VLE), the UHI student and staff newsletter, and an email to all students and staff at the UHI. The total number of students who were enrolled on the UHI email system in 2010/11 was approximately 7,000, of which roughly 54% were mature students over the age of 25.

4.7.2 Inclusion criteria

Inclusion criteria established that participants could undertake PA freely, could understand the language of the intervention (English), could use the VLE and were not currently already undertaking the government recommended levels of PA. Participants were required to be between the ages of 18-65, to not have any restrictions due to mobility problems or chronic illness, to not be suffering from any mental health problems that could preclude their engagement or understanding of the content, could speak, write and understand English, wished to participate, have access to the UHI VLE and a UHI email account and were not currently undertaking 30 minutes a day of PA on five days a week.

4.7.3 Sample Size

A clinically significant difference of walking has been noted as 1000 step counts per day (Richardson et al., 2007). Individuals were asked to measure walking over 5 days so this would amount to a difference of 5000 per week if a change was to be clinically significant. In a previous study using a website intervention, standard deviation of 2000 steps was recorded (Richardson et al., 2010). 1000 steps is roughly equivalent to 10 minutes of walking. The study included participants who were not currently undertaking 30 minutes of PA for 30 minutes a day 5 days a week.

In previous studies sedentary behaviour to moderate activity has been proposed at the following step counts: 5,000 to 7,499 is considered low active and 7,500 to 9,999 is presented as 'somewhat active' (Tudor-Locke & Bassett Jr, 2004). On the basis of these figures a power calculation was based on

current walking step count estimated at 6250 (taking the median of somewhat active), and an estimated increase of 1,000 per day and a standard deviation of 2000 as clinically significant difference.

4.7.3.1 Power calculation

Using Lehr's formula (Lehr, 1992) for unpaired data whereby N=k/ (difference/SD)^2 where K is 29.8, and power at 90% and p <.01, sample size is 119.2.

4.7.4 Participant flow

The consort diagram in figure 4.1 illustrates the numbers of participants at each stage of the study, as well as those lost to attrition. 68 participants completed pre and post-test questionnaires; baseline pedometer and diary submission and at least one week of pedometer readings/diary recording following base line. The distribution of these 68 final participants consisted of Group 1 (intervention): N = 15; Group 2 (intervention + SS): N= 16; group 3 (SS only): N = 18 Group 4 (control): N = 19. The group sizes were roughly equitable at the four week post intervention point. When the groups were collapsed into intervention or practitioner support, the intervention group consisted of N=31 while the practitioner support group consisted of N = 36.

4.7.5 Attrition

Total attrition from all four groups from study allocation point to post-test, was 19.

Key:
Group 1: Intervention (INT)
Group 2: Intervention & Practitioner Support (INTSS)
Group 3: Practitioners support only (SS)
Group 4: Control (C)

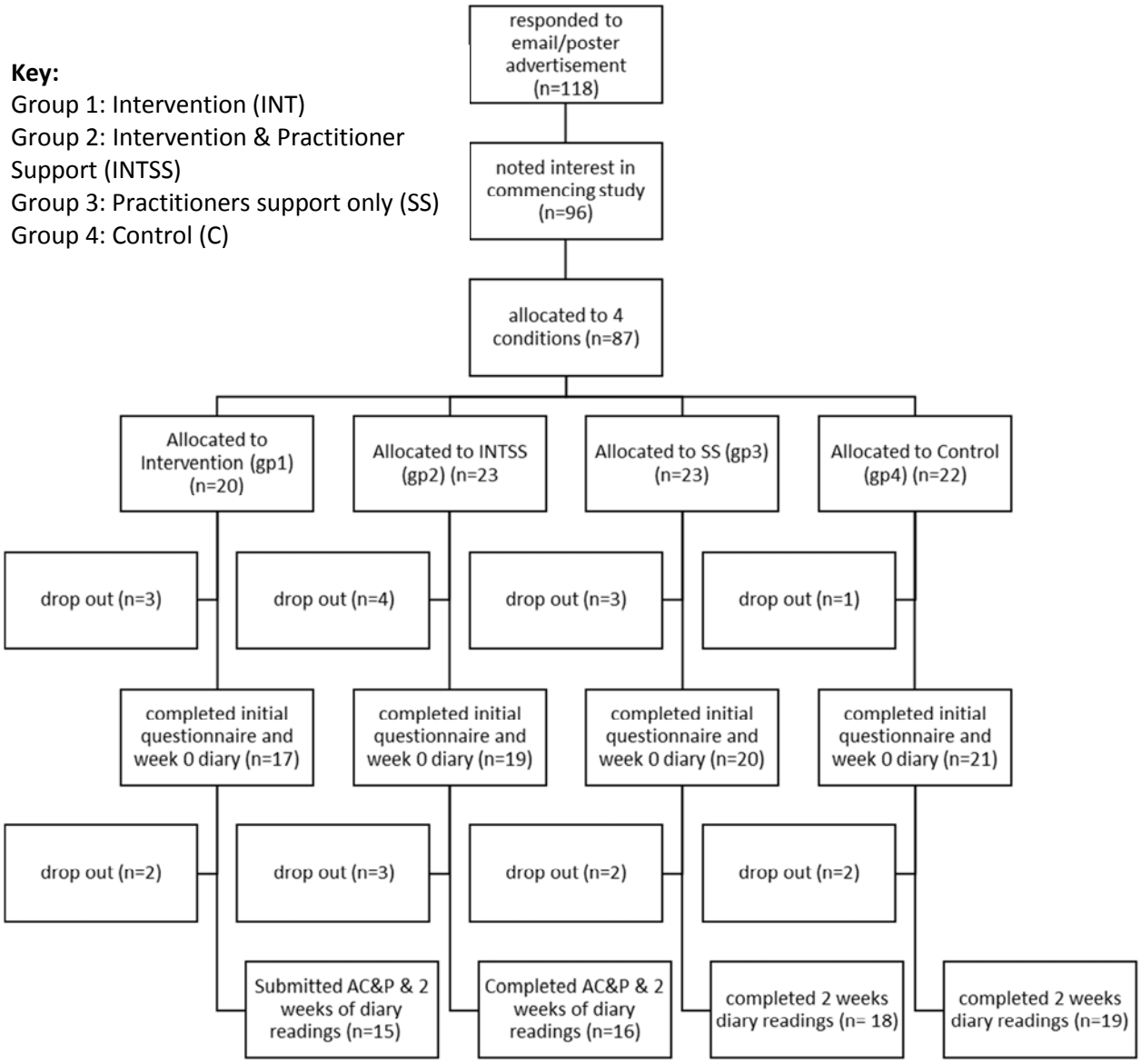

Figure 4.1 Flow of participants and attrition from recruitment to completion over 4 weeks

4.8 Measures

4.8.1. Physical Activity

In order to examine Hypotheses H2, H3, H4 and H5 PA was measured. Self-report data of PA and objective measurements using pedometers were used to measure PA and walking scores respectively.

4.8.1.1 Self-Report Physical Activity Diaries

PA encompasses a very broad range of moderate to vigorous activity across several domains, including house or garden work (Scottish Government, 2011). The criteria for recording PA, was that the PA needed to be for a minimum of 10 minutes of activity which increased heart rate. This requisite was in tandem with that outlined by the Scottish Government (2011) guidelines. Participants were required to enter this information into the diary and undertake this task for 5 days out of 7 for 4 weeks.

By capturing what people believed they could include in their day, rather than dictating a particular form of activity, participants were able to select whatever PA was easiest to fit into their lives and was in accordance with the principles of the PA guidelines (Bull, 2010).

Diary information could then be coded categorically differentiating between whether PA increased or did not increase. The criteria for establishing an increase is explored more fully in the results section. In order to determine if self-set goals were achieved, the diaries were scrutinised and compared to the goals.

4.8.1.2 Pedometers

PA diaries are a useful self-monitoring tool, however, it was also important to obtain a more objective measurement (Tudor-Locke et al., 2006) as self-reporting of PA can be less reliable (Armitage & Conner, 2001; Prince et al., 2008). The need to obtain research sensitive standard pedometers or ideally accelerometers, is repeated by many authors (Clemes, O'Connell, Rogan, &

Griffiths, 2010; Mears, 2010; Tudor-Locke et al., 2006). While this recommendation has clear value to providing robust data, the practicalities and cost implications of using expensive research standard recording devices may limit the implementation within health service contexts. The capacity to upscale an intervention to a broad campaign in the health service, is one element of a gold standard of intervention research (Glasgow et al., 2002); where budgets are restricted, this has obvious implications when questions need to be raised about who bears the cost (Glasgow et al., 2002; Rogers, 2008).

Using robust pedometers is a middle ground and enables collection of objective data, though with some caution about the precision of measurements (Schmidt, Blizzard, Venn, Cochrane, & Dwyer, 2007). On this basis, combining practical cost implications and the need for objective monitoring, robust pedometers were used.

Participants were asked to record pedometer readings on 5 out of 7 days for 4 weeks which includes pre and post-test.

4.8.2 Action and Coping Plans

Participants were asked to record the goals they wished to achieve with specific detail about how, when, where and with what support. They were asked to submit one copy into the virtual learning environment system and to save and print the other one and place it in a prominent position.

The manner in which the plans were categorised and analysed and used to compare with behavioural outcomes to establish if self-set targets were met, is discussed in the data analysis section 4.9.1.1.

4.8.3 Measuring TPB constructs

In order to adequately assess if the intervention was effective in increasing PBC and/or resulted in any changes to other constructs of the TPB, it was necessary to measure TPB constructs both at pre-test and post-test. Guidelines for constructing questionnaires and testing for validity are offered by Francis et al. (2004).

Francis et al. (2004), propose an elicitation study to determine the relevant beliefs to the particular behavioural domain is critical to ensuring the validity of the questionnaire – are the beliefs that are being measured relevant to this population for this behaviour. The value of isolating the beliefs through elicitation studies is eschewed also by Ajzen and Driver (1992) and others given that modal beliefs from a general population have been found to be significantly different from the beliefs isolated with a specific population (Steadman, Rutter, & Field, 2002). Though previous PA elicitation studies have been undertaken (Sutton et al., 2003), a Highland university staff student population may have unique beliefs about PA in part due to the perceived beliefs about inclement weather (Tucker & Gilliland, 2007) as well as the accessibility to PA venues due to the remote and rural nature of their domicile (Humpel, Marshall, Leslie, Bauman, & Owen, 2004).

Following the distribution and analysis of the elicitation of salient beliefs questionnaire, a PA TPB questionnaire was constructed and piloted with a unique representative sample of individuals who met the inclusion / exclusion guidelines set out for the main study. The questionnaire construction and piloting is presented in Appendix 4.

The final validated questionnaire was delivered both at pre and post test to detect attitudinal shift as well as to determine the effectiveness of the intervention to increase PBC, and to assess the predictive nature of the PBC on PA. Using the questionnaire enabled the testing of hypothesis 1: the intervention (techniques to increase PBC and action and coping plans) will lead to increased levels of PBC. The questionnaire can be seen in Appendix 5.

4.8.4 Evaluating Intervention Acceptability

Acceptability of the intervention will be examined through the following question:

What was the acceptability of the internet intervention and practitioner support and what improvements would render it more acceptable?

The use of acceptability questions is recommended when piloting interventions (Bowling, 2005), and the use of qualitative methods for doing so provides valuable information for future iterations of the intervention (Steele et al., 2007).

Acceptability has previously been surmised on the basis of participant attrition rates (Darker et al, 2010), however this can be a poor indication of acceptability as reasons for dropping out of a study can be many and varied (Christensen & Mackinnon, 2006). In this present study, it was decided to measure the acceptability of the tool in order that more extensive feedback could contribute to future adaptations of the tool.

Previous intervention studies assessing acceptability have asked questions about the usefulness and satisfaction of the intervention and whether they would recommend it to others (Richardson et al., 2007; Steele et al., 2007) alongside open ended questions for improvement suggestions (Vandelanotte & De Bourdeaudhuij, 2003).

Both Likert style questionnaires to draw on ‘what worked’ and ‘what didn’t’ alongside qualitative feedback to draw out opinions of how it worked or didn’t (Liebreich, Plotnikoff, Courneya, & Boulé, 2009), have also been previously employed to measure acceptability.

In this study using Likert style questions and open restricted questions, participants who were in intervention conditions were asked at post-test only, about perceived value, satisfaction, efficacy and suggestions for future adaptations to assess acceptability alongside whether they would use it again

and recommend it to others consistent with previous literature (Leibreich et al., 2009; Vandelenotte & De Bourdeaudhuij, 2003). All questionnaires are provided in appendix 5.

4.9 Data Analysis

4.9.1. Quantitative analyses

Statistical analysis was undertaken using SPSS 19 and IBM 21. Data was first inspected to assess for normality of distribution using histograms, box plots, skewness and kurtosis values and the test of normality, Kolmogorow-Smirnov (see Appendix 7 for Kolmogorow-Smirnov figures for pre-test TPB figures and walking). Not unusually for research in the area of behaviour, many of the variables did not display a normal distribution (Micceri, 1989). Several parametric tests are claimed to be sensitive where data are not normally distributed which may incur the risk of producing a type 1 (rejecting the null hypothesis when it is indeed, true) or conversely a type 2 error (accepting the null hypothesis when it is false) (Cribbie, Fiksenbaum, Keselman, & Wilcox, 2012).

The choice therefore was whether to rank the data and then use a parametric test or to use a non-parametric equivalent (Tabachnick & Fidell, 2013). However each of these approaches has limitations and drawbacks. Where data is categorical then ranking can be appropriate, but in the case of walking for instance, ranking or transforming the data may obscure the nature of the variables and the differences that were being examined (Osborne, 2002). The use of a non-parametric statistical test may not be able to reveal the size of effect and can similarly be prone to type 1 errors (Whitley & Ball, 2002).

Parametric statistics used with non-normal data has been recorded as less risky with large samples (Lumley, Diehr, Emerson, & Chen, 2002), however the definition of large has often been obscure. More recently, simulation analysis results portend that even with samples below 100, non-normal data can be used with parametric tests (Lumley et al., 2002). It has been contended that parametric tests are sufficiently robust and that the assumptions about

violations that accompany the rejection of using parametric statistics in non-normal data, have been over emphasised (G. Norman, 2010). The important criteria in determining choice of tests is the meaning that can be interpreted from the result (Lumley et al., 2002), and in this study, much of the data provides greater meaning in its original form.

Where other tests such as multiple regressions, and correlations are used, normality of data is again advised (Lumley et al., 2002). When tests of this type were used to examine the data in this study, the normality of the data was investigated and decisions on the acceptance or otherwise of the outputs of the tests is discussed and presented. The approach of examining the outputs throughout the analysis rather than normalising data, is recommended as providing the more meaningful interpretation of the outcomes rather than a blanket transformation of data or use of non-parametric statistical tests (M. N. Williams, Grajales, & Kurkiewicz, 2013). Consequently, any significant results should be interpreted with some caution due to risk of error that this approach can accommodate.

4.9.1 1 Physical Activity Diaries and Action and Coping Plans

To test hypotheses two, three, four and five (H2, H3, H4 and H5), PA was measured through pedometers and self-completed diaries throughout the two weeks of the intervention as well as at pre-test and post-test. Self-report diaries recorded freely chosen PA. The data in the diaries was logged qualitatively but examined by coding the data categorically. Guidelines to assess PA diaries are varied with incumbent strengths and weaknesses (Ainsworth, Cahalin, Buman, & Ross, 2014; Warren et al., 2010). While some recommend use of a procedure for mapping behaviour to a metabolic equivalent (MET) calculation based on intensity, duration, frequency and type of activity (Warren et al, 2010), others question the rigour of such a process and whether it can produce robust results (Armitage, 2005). But translation of diary data into MET's can be prone to error (Ainsworth et al., 2014). Indications are that the errors are random rather than in any one direction, particularly when the PA is of low intensity (Valanou, Bamia, & Trichopoulou, 2006).

In this case, PA diaries were inspected and a calculation made based on the fulfilment of one or more of the following conditions averaged over a 5 day period: an additional 10% of activity had been undertaken, the point at which there can be a benefit to health (Warburton et al., 2006); an additional 1000 steps which is a figure based on clinical significance (Richardson et al., 2007); an additional average of 10 minutes of activity was recorded, which has been estimated as roughly equivalent to 1000 steps (Tudor-Locke et al., 2004). This calculation provided information to establish if, in the first instance, the activity increased or decreased.

Hypothesis (H4) that those who set targets will achieve targets set was tested through examining the PA diaries in relation to the goals set in the action and coping plans which had been submitted in the base line week (week 0). Participants in the intervention conditions submitted targets through the module 'grade centre' indicating what they hoped to achieve. The PA diaries alongside the step counts were inspected over the subsequent three weeks (weeks 1 – 3) to see if the participant had met the goals set in the action and coping plans on one or more subsequent weeks. The data was coded dichotomously as achieved or not achieved depending on whether the goal was achieved. If the participant had a target of, for example, increasing walking by 2000 steps in a week, then the goal was marked as achieved, if the pedometer reading indicated an overall increase of a minimum of 2000 steps in either subsequent week. Alternatively, if participants aimed to increase the amount of swimming by an additional half an hour, then again, this was marked as achieved if this goal was evident in either of the subsequent weeks. Where participants noted simply that they wished to take up an activity, say for example, to start playing football every Saturday, then this was recorded as achieved if football was recorded as being played in either subsequent week. Ten percent of the data was subjected to examination by an independent researcher in order to establish inter-rater reliability. Where there was any discord in the analysis, these were resolved through discussion. A sample of a PA diary can be seen in Appendix 8 and a sample completed action and coping plan is attached in Appendix 9.

4.9.2 Qualitative analyses: A Thematic approach

The responses from the open questions on acceptability were analysed using Thematic Analysis (TA), drawing on recommendations from Pope and Mays (2000). These guidelines are in concert with the premises of qualitative analysis presented by Lewis, Ritchie and Dillon (2003) and those of Braun and Clarke (2006).

Importantly, in this form of analysis, the researcher is accepted as being intimately connected with the content of the data, and as such the process requires transparency in the approach that is taken, and the analysis that is generated (Pope, Ziebland, & Mays, 2006). There can be a tacit assumption that where the research examines qualitative data, there is a risk of bias, but some (Denzin & Lincoln, 2009) contest this view. Denzin and Lincoln (2009) argue that equal risks exist in the interpretation of quantitative data, given that any research is bound by the presumptions of a particular time and place that inform the approaches to conducting the research, and the analysis of results. Data needs to be synthesised in such a way as to make sense of a theoretical framework (Braun and Clarke 2006) and to ensure transparency about the method of analysis regardless of whether it is a qualitative or quantitative approach.

TA approaches data objectively and data are treated as evidence whereby through following the same procedure and methods of data collection and analysis, any subsequent researcher should be able to extract similar conclusions (Mays & Pope, 2000). Although sharing many similar features, TA is distinct from an epistemological approach in which the researcher's position, knowledge and perspective are central to the analysis of the data such as that of Interpretative Phenomenological Analysis (Braun & Clarke, 2006). However, there is value in a declaration and acknowledgement of the position and stance of the analyst to reveal any biases that may be present, as noted above (Pope, Ziebland, & Mays, 2000; Willig & Stainton-Rogers, 2007). Some authors (Fine, Weis, Weseen, & Wong, 2000), purport that qualitative data analysis can never be entirely bias free, and that by exposing individual experience and opinions,

the researcher lays bare the possible influences that may have infiltrated the analysis. This perspective is shared by Braun and Clarke who stress the importance of acknowledging any pre-conceived assumptions (2006).

Guidance recommends that an extensive familiarity with the data is only achieved by reading and re-reading (Pope et al., 2006; Spencer, Ritchie, Lewis, & Dillon, 2003) in order to commence coding and interpreting the data and to detect initial emerging themes. This increased familiarity may again bring risks that personal values and positions may come to bear in the analysis. In this case, the researcher was very familiar with the literature and background, though all implementation of the intervention was conducted according to the manual and was intransigent due to the digital delivery mechanism.

After initial data familiarisation, the data was coded and a coding framework designed, after which, a further coding exercise was undertaken using the coding framework. This process was iterative and inductive. It was repeated and reviewed until no new codes emerged. The codes were then analysed to establish any emerging themes. In each stage, a proportion of the coding and TA was undertaken by an independent researcher to ensure robust analysis of data. Any differences were resolved through discussion.

Table 4.4 illustrates the tasks and sequencing of these tasks for TA.

NB: Where participant quotes are included in the text of this study, these are presented without correction, but rather, as they were written.

Table 4.4: Phases of Thematic Analysis (Braun and Clarke, 2006)

Description of the TA process phases
1. Familiarising yourself with your data:
Transcribing data (if necessary), reading and rereading the data, noting down initial ideas.
2. Generating initial codes:
Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:
Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:
Checking in the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic “map‟ of the analysis.
5. Defining and naming themes:
Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells; generating clear definitions and names for each theme.
6. Producing the report:
The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

4.9.3 Description of Sample

For those who commenced the study, descriptive data is provided in table 4.5. This table illustrates the distribution of the sample according to the demographic categories of age, gender, occupation and distance from a large town.

Table 4.5: Background descriptive information all participants

Descriptive Information	Frequency	Percent
Gender		
female	69	79.3
male	18	20.7
Age		
18-25	18	20.7
26-35	24	27.6
36-45	14	16.1
46-55	25	28.7
56-65	6	6.9
Occupation		
lecturer	16	18.4
administrator	9	10.3
management	8	9.2
student	31	35.6
other	23	26.4
Distance from town		
live in large town	31	35.6
takes me 1/2 hour to town	34	39.1
takes me hour to town	8	9.2
more than an hour to town	14	16.1

Distribution of gender was strongly in favour of females at nearly 80% of the total participant numbers. Overall make up of students at UHI is 54% female and 46% male, however, the sample also drew extensively from a staff population for which no figures were available to estimate population gender split.

The distribution of age, as can be seen in table 4.5 was roughly split between the 18–25, 26-35 and the 46–55 age bands, with somewhat lower numbers in the 36–45 age band.

35% of the sample were students while the remaining 65% were non students and a majority of these were staff, at roughly 40%. The email list at UHI includes people who may have taken a Continuing Professional Development (CPD) module, in other words, who are neither full-time nor part-time students. These may be individuals who do not count themselves as students and who are studying to either improve their employment portfolio or who are currently employed.

The distribution of the sample according to the distance of domicile from a large town was broadly spread, with the majority of participants living either in or within ½ hour travelling distance of a large town. This gives an indication of how far people might have to travel to reach a leisure centre or similar facility.

4.9.4 Attrition

Attrition refers to the participants where data are not available (Eysenbach, 2005). Eysenbach (2005) distinguishes between two different types of attrition – non usage attrition, where participants remain on the programme but fail to engage with the intervention nor submit full data, or drop out attrition which he ascribes to the phenomena of participants being lost to the programme.

The drop out participants in this study were recorded as those who dropped out after completing the original questionnaire and who no longer submitted after this point (N = 11). Non-usage participants completed pre and post questionnaires but failed to complete more than one week of diary and pedometer readings and did not submit an action plan (N = 8).

Missing data was recorded for participants (N = 6) who commenced the intervention and completed both the pre and post questionnaire and completed a minimum of the base line and two weeks of data following pre-test, but may have missed recording one week of data or a question in the questionnaire/s.

The overall drop out attrition figure in this study was 30% from enrolment onto programme through to the submission of the final week of data submission.

In order to determine whether there were significant personal characteristics or attitudes to PA that may have distinguished between those who completed and those who did not, a binary logistical regression was performed. Completion and non-completion of diaries was used as the criterion variable. The non-completers were those who did not complete diaries and completed only the pre-test TPB questionnaire. Completers submitted a minimum of pre-test diaries plus one additional week and both pre-test and post-test TPB questionnaires.

The predictor variables that were entered were the demographic variables of age, how far from a large town, gender, which condition they had been allocated to, current PA and occupation. Intention and PBC as measured by the TPB pre-test questionnaire were also entered on the basis that those who have low belief in their ability and the ease of undertaking PA and those who had low intention of undertaking PA, may have been more likely to have withdrawn from the study. The predictor variables were first tested for multicollinearity to determine if there was a violation of this assumption. If the relationship between two or more of the predictor variables is highly correlated then the model may be unsafe, however the tolerance values were all within safe limits between 1.04 and 1.19. The full model containing all of the predictors was not statistically significant. X^2 (17, N = 84) = 21.743, p = .195. However, the output for the Hosmer Lemeshow Goodness of Fit Test did indicate support for the model X^2 (8, N = 84) = 8.553, p = .381. The model as a whole explained between 22.8% (Cox and Snell R square) and 31.3% (Nagelkerke R square) of the variance in the non-submission of diaries. The model was able to correctly classify 73.8% of the cases. Only one of the independent predictors, *group*, made a statistically significant contribution to the model, as illustrated in the table (see Appendix 10). Within group, only the intervention and practitioner support group (INTSS) was significant with the odds that this group were .074 times more likely to submit a diary than participants in the control group. On the whole, the drop out from the study in not likely to be attributable to any demographic characteristics, or related to intentions, or confidence in PA. There is only a marginal difference between those in the intervention and practitioner support condition, such that these individuals were less than .1% likely to submit diaries, than the control condition. The full table can be seen in Appendix 10.

4.9.5 Reliability of TPB Questionnaire

As noted above the questionnaire was constructed based on an elicitation pilot which drew on the salient beliefs about 30 minutes of PA 5 days a week, for the specific population (staff and students of the University of the Highlands and

Islands). Intention was measured through three statements each using a 7 point Likert scale along the continuum of Strongly Disagree to Strongly Agree. The range of responses is: 3 (1 + 1 + 1) to (7 + 7 + 7) 21 and calculated to find the mean.

Attitude was measured drawing on the five behavioural beliefs established in the pilot salient belief questionnaire about the advantages of PA and five corresponding outcome evaluations of these beliefs. The questionnaire items were measured using a 7 point Likert scale. Attitude scores were calculated by multiplying the behavioural belief by the associated outcome evaluation across each belief, and adding each of these sums together to emerge with a composite attitude score and finding the mean of these scores. Given the 7 point scale the possible maximum and minimum response was (7 x 7) + (7 x 7) + (7 x 7) + (7 x 7) + (7 x 7) = 245. (1 x 1) + (1 x 1) + (1 x 1) + (1 x 1) + (1 x 1) = 5

The measure of subjective norm was similarly measured by constructing items reflecting the most regularly noted social referents from the salient beliefs questionnaire; partner/husband; friends; doctor as well as an evaluation of the importance of adhering to the norms of these individual/s. Again the final measurement score was calculated according to guidance by Francis et al (2004) by multiplying each social referent approval by the corresponding evaluation of Motivation to comply with others. The possible maximum and minimum response was: (7 x 7) + (7 x 7) + (7 x 7) 147 through to (1 x 1) + (1 x 1) + (1 x 1) = 3.

PBC was measured by constructing a series of 4 items to measure self-efficacy and controllability. Five questions using a 7 point likert scale allowed for a mean of between 5 and 35.

The results of reliability testing of the questionnaires are presented in the table 5.3 below for each of the items at pre and at post-test. The reliability measure of each of the constructs is equitable to reliability measures produced in other PA TPB studies such as that of Darker et al. (2010), where Cronbach's alpha

figures of .85, for attitude, .75 for subjective norm, .85 for PBC and .80 for intention were obtained from a TPB questionnaire constructed to examine beliefs and cognitions about walking in the general public. By contrast, the pre-test Cronbach's alpha for each of the constructs in this study was attitude at .890, subjective norm .733, intention .74 and PBC .788. At post-test, the Cronbach's alpha coefficient results were attitude .908, subjective norm was .826, intention was .839 and for PBC, it was .870. These results are presented in table 4.6 for both pre-test and post-test which also shows the number of items per construct.

Table 4.6 TPB Reliability Statistics: Pre-test and Post-test

TPB Reliability			
	Cronbach's Alpha pre-test	Cronbach's Alpha post- test	N of Items
Attitude	.890	.908	10
Subjective norm	.733	.826	6
Intention	.740	.839	3
PBC	.788	.870	5

Chapter 5: Results

5.1 Results Introduction

This study set out to test a number of hypotheses to determine the efficacy and acceptability of an online PA intervention. The results are presented in two central sections to examine the efficacy of the intervention through hypotheses one through to five, and the research question on acceptability. The first section is devoted to the efficacy of the intervention, with data which was largely quantitative. The following section uses primarily qualitative data to examine the acceptability of the intervention. However, as outlined in the previous chapter, the qualitative data was used both for the purposes of triangulation and completeness and hence qualitative data, as appropriate, have also been used to add deeper understanding to the efficacy of the intervention.

5.1.1 Hypotheses

H1. The intervention (techniques to increase PBC and action and coping plans) will lead to increased levels of PBC.

H2. The intervention will lead to increased levels of PA measured through pedometers and self-completed diaries

H3. The intervention and practitioner support will lead to increased levels of PA over and above that achieved by those in receipt of practitioner support or intervention only

H4. Those who set targets will achieve targets set.

H5. Walking and PA for those in the control group will remain unchanged.

5.2 Effectiveness of Intervention

The efficacy of the intervention was tested through the five hypotheses.

5.2.1 H1: The intervention will lead to increased levels of PBC

The initial statistical analysis examined PBC to determine if the intervention had been effective in increasing PBC.

The descriptive statistics for pre and post-test TPB results illustrate that across all conditions, subjective norm, attitude, and PBC increased, and intention decreased. The differences though, as evident in figures 5.1 to 5.4 and table 5.1, were small.

Table 5.1: Mean (M) scores and standard deviations (SD) of TPB measures at pre and post test

	INT		INTSS		SS		C	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Attitude	177.75 (45.41)	187.8462 (57.624)	200.77 (37.7)	207.2667 (40.38)	171 (75.2)	200.6471 (58.86)	188.27 (55.02)	193.9412 (57.47)
Subjective norm	84.05 (31.18)	97.5385 (33.84)	91.78 (25.15)	103.7333 (27.76)	100.90 (31.68)	103.7647 (27.99)	93.9 (17.37)	102.5882 (25.42)
PBC	22.1 (6.6)	28.3846 (6.21)	16.8 (3.6)	20.9333 (5.72)	19.5 (6.95)	21.4706 (6.58)	17.42 (5.6)	21.2353 (6.48)
Intention	15.79 (4.08)	13.9231 (2.29)	16.08 (2.47)	13.6000 (1.80)	16.14 (3.69)	14.3529 (1.54)	16. (3.22)	13.8824 (2.08)

The subjective norm mean figures at post-test for every condition are slightly elevated from pre-test mean subjective norm figures as illustrated in figure 5.1. There was a statistically significant increase in subjective norm from pre-test (M = 92.06, SD = 26.089) to post-test (M = 102.1, SD = 27.517) t (62) = -4.21, p <.005. The mean increase was 10.04 with a 95% confidence interval ranging from -15.879 to 4.21. The eta squared statistic (.23) indicates a small effect size.

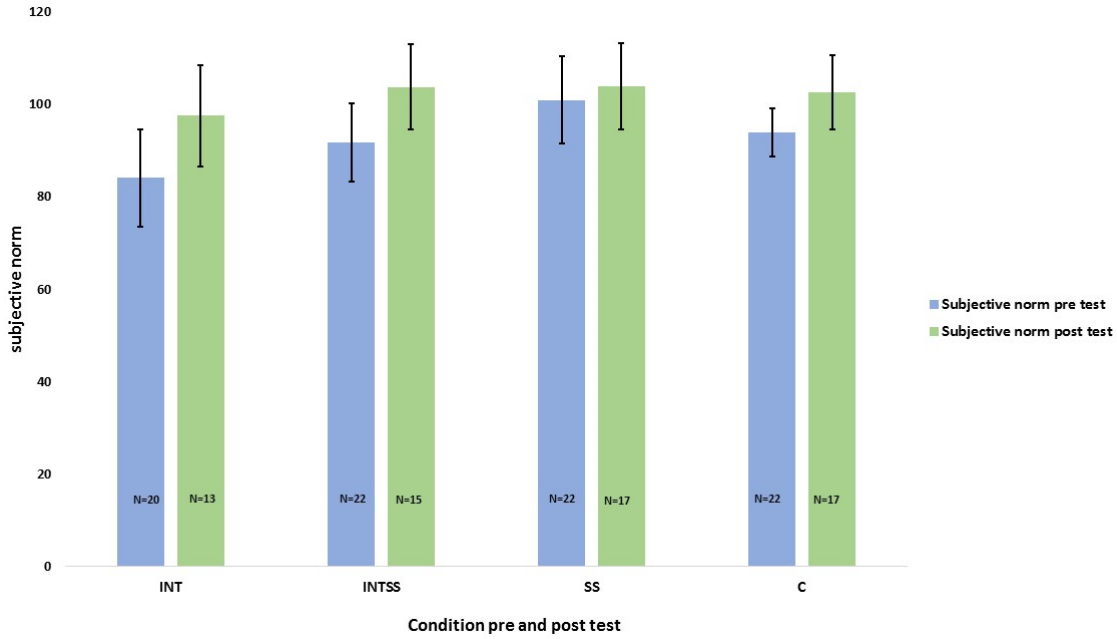

Figure 5.1: Subjective Norm mean levels with standard deviation error bars for each group at pre and post time points with participant numbers (N) for each group noted on the bar.

Mean figures for Intention conversely decreased, again in across all conditions from pre-test to post-test illustrated in figure 5.2. There was a statistically significant decrease in intention at pre-test (*M* = 16.13, *SD* = 3.16) to post-test (*M* = 13.98, *SD* 2.03) t (65) = 6.34, *p* <.005. The mean decrease was 2.15 with a 95% confidence interval ranging from 1.47 to 2.82. The eta squared statistic (.39) indicates a medium effect size.

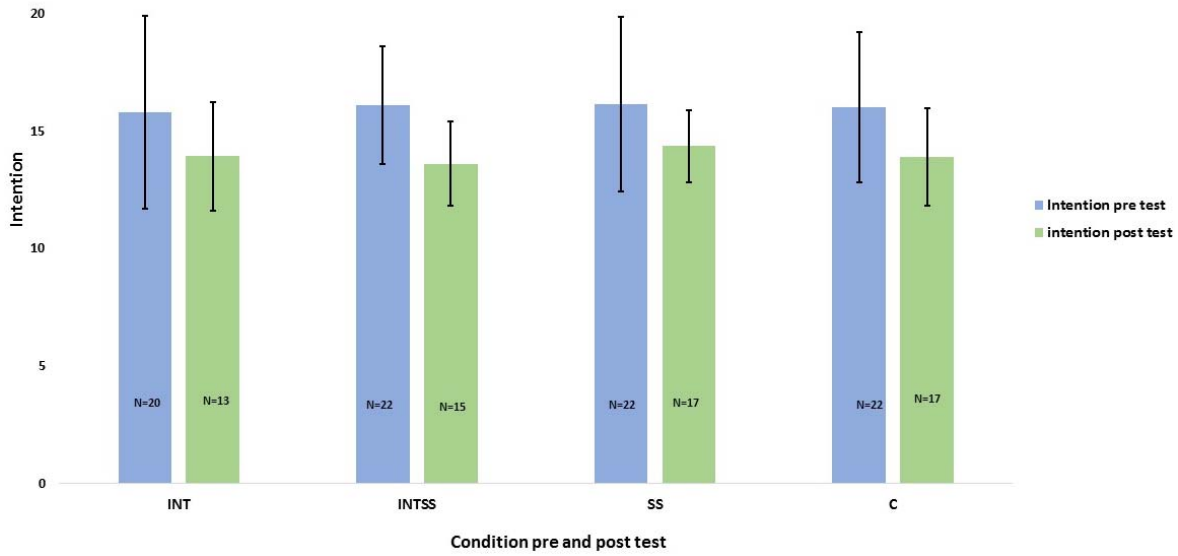

Figure 5.2: Intention mean levels with standard deviation error bars for each group at pre and post time points with participant numbers (N) for each group noted on the bar..

Figure 5.3 demonstrates that mean attitude figures are roughly equivalent between measurements at pre-test and post test. There was no statistically significant increase of attitude from pre-test (*M* = 183.69, *SD* = 54.96) to post-test (*M* = 198.34, *SD* = 52.23) *t* (66) = -1.89, p <.063. The mean increase was 14.65 with a 95% confidence interval ranging from –30.138 to .824.

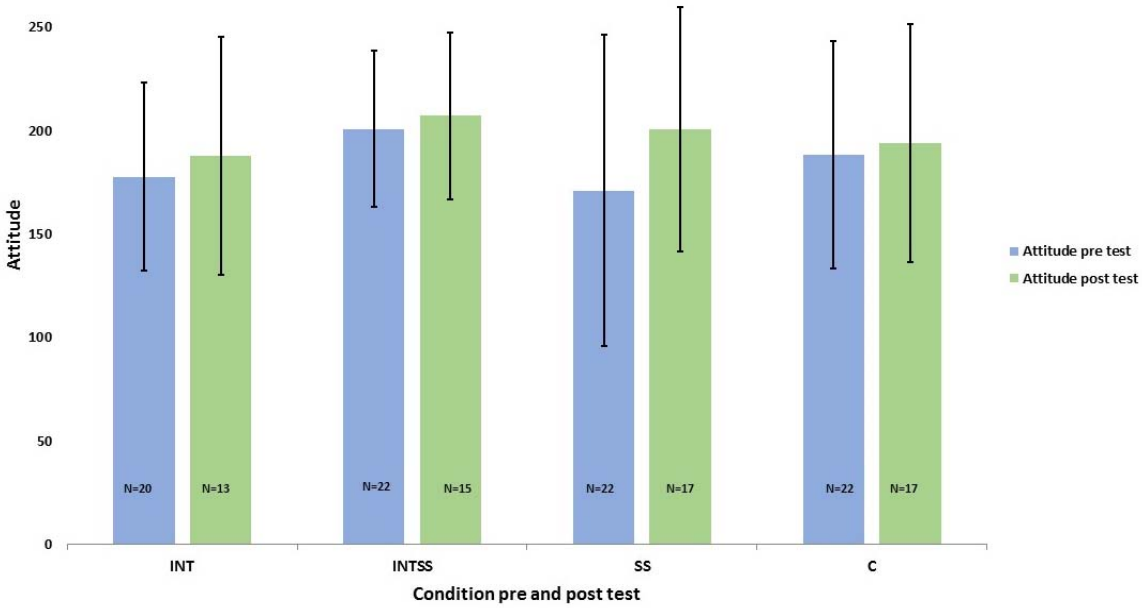

Figure 5.3: Attitude mean levels with standard deviation error bars for each group at pre and post time points with participant numbers (N) for each group noted on the bar..

PBC figures are slightly increased from pre-test to post test and the greatest increase appears to be in the intervention condition as illustrated in figure 5.4. There was a statistically significant difference in the TPB scores from pre-test to post-test for PBC; pre-test (M = 19.1, SD = 5.8) to post-test (M = 21.84, SD = 6.25) t (67) = 3.59, p < .005 (one tailed). The mean increase in scores is 2.73 with a 95% confidence interval ranging from -1.21 to 4.26. The eta squared statistic (.16) indicates a very small effect size.

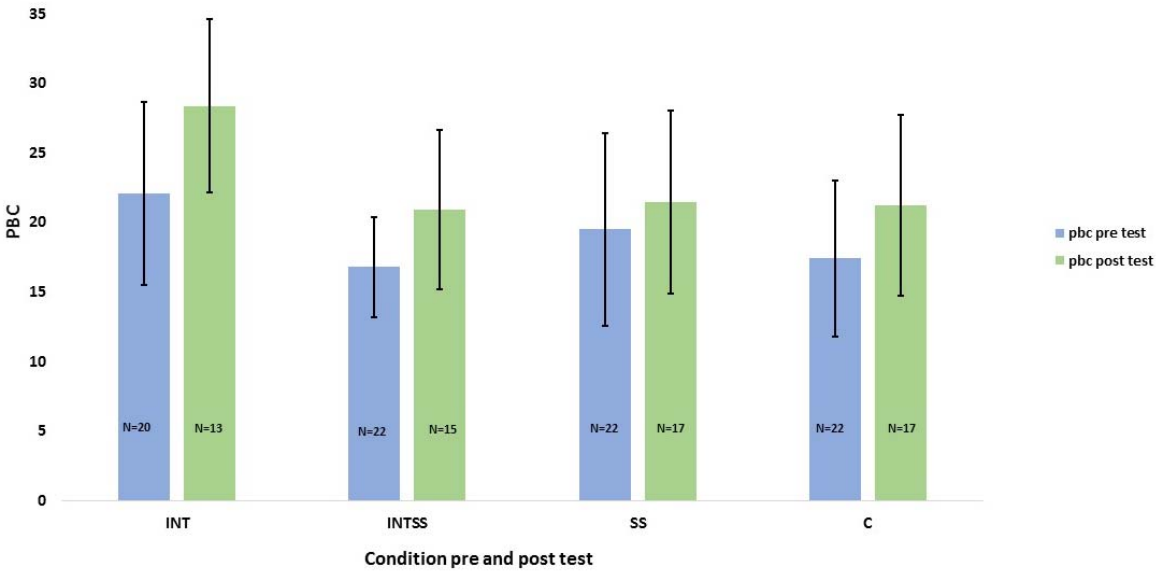

Figure 5.4: PBC measured for each group at pre and post time points with participant numbers (N) for each group noted on the bar. The descriptive data appeared to suggest differences in the TPB outcomes between pre-test and post-test. A paired sampled t-test was conducted to determine if these differences were significant, for all participants regardless of condition.

Scores for PBC did increase, as did subjective norm, but intention decreased. This was measured across all conditions and further tests were required to determine if there were significant differences between conditions that could account for the increases in PBC and subjective norm.

To determine if the intervention and/or practitioner support may have had an effect on the scores all of the TPB constructs and the relationships between them, the scores of each of the variables in the TPB were compared using a between groups Multivariate Analysis of Variance at post-test. The dependent variables were the TPB scores at post-test (consisting of attitude, intention, subjective norm and PBC). The independent variable was 'group' indicating the 4 different conditions. Preliminary assumption testing was conducted on collinearity, univariate and multivariate outliers and normality homogeneity. Box's text of equality of covariance matrices indicates that variance-covariance homogeneity had not been violated. Levene's test values are all above .05 indicating an assumption of equality of variance for each variable. There was

no statistically significant difference between groups on post intervention TPB scores, *F* (12, 146) = .56; Wilks' Lambda = .89, *p* =.88 indicating that for all groups, the scores for PBC, attitude, intention and subjective norm were not significantly different and any difference was due to chance, rather than due to the intervention and/or practitioner support.

In order to examine if there was any effect from the intervention alone (as distinct from the practitioner support) on PBC, the groups were collapsed into two – those who had received the intervention and those who had not (Intyes vs Intno). This procedure enabled the two conditions to be examined with greater numbers and in isolation to each other. Similarly this facilitated more specific scrutiny of the potential effect of the intervention on PBC, which is in line with the hypothesis.

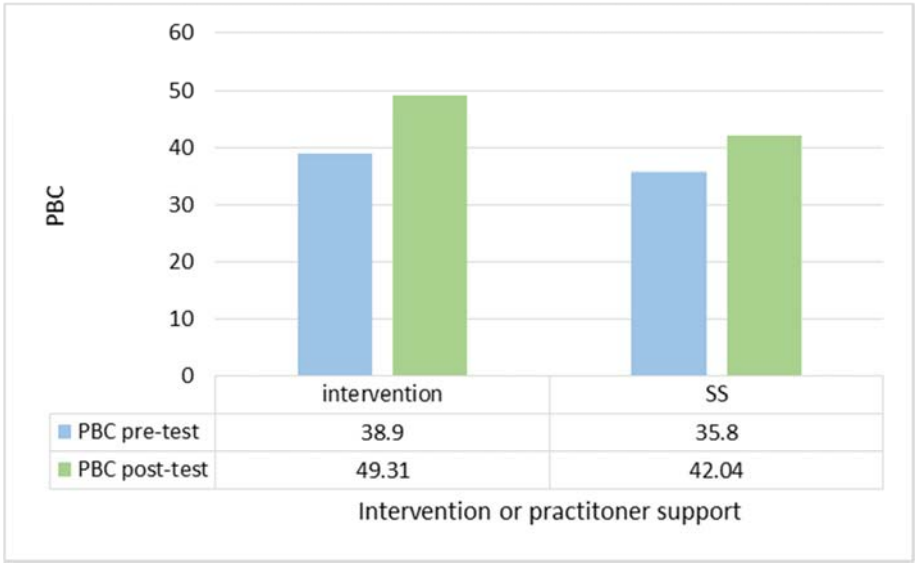

Figure 5.5 PBC pre and post-test intervention or practitioner support

Two mixed between within analysis of variance (ANOVA) were conducted to determine the impact of the intervention on PBC, and a separate analysis to determine the impact of practitioner support on PBC.

The analysis of the intervention condition found that there was no significant interaction between intervention yes or no and pre and post-test. Box's test for equality of covariance matrices was violated, as the significance value was

smaller than .001. However, Box's test can be strict and the use of Pillai's trace when there has been a violation, is recommended (Olsson, 1979).

Pilai's trace = .018, F (1, 65) = 1.160, p = .286, partial eta squared = .018. There was a large main effect for time, Pillai's Trace = .161, F (1, 65) = 12.449, p = .001, partial eta squared = .161. There was no significant effect for the condition of intervention or no intervention on PBC scores at pre and post-test, F (1, 65) = 1.160, p = .286, partial eta squared = .018

The analysis of the practitioner support, where Box's test of equality of covariance was not violated, nor was there a violation of the Levene's test of equality of variances, found that there was no significant interaction effect of time and practitioner support on PBC, Wilk's Lambda = 1.0 F (1, 65) = .003, p = .959, partial eta squared = .000. There was a substantial main effect of time, Wilks Lambda = .847, F (1, 65) = 11.748, p = .001, partial eta squared = .153. There was no significant effect of condition (practitioner support yes or practitioner support no), F (1, 65) = 2.082, p = .154, partial eta squared = .031.

Any change in PBC therefore, appears to be due to time, as all participants increased regardless of condition and therefore suggest that it change cannot be attributed to either the intervention or practitioner support.

The increase in PBC and subjective norm was observed across all conditions and was not isolated to the experimental conditions indicating that the changes in the scores would not have been due to the intervention and /or practitioner support. These analyses suggest therefore that the hypothesis that the intervention would lead to increases in PBC cannot be supported.

5.2.2 H2, 3 and 5: The intervention will increase walking, further enhanced by Practitioner support

5.2.2.1 Self-Report PA Diaries.

To test Hypotheses two and three (H2: The intervention will increase PA and H3: The intervention will increase PA which will be further enhanced by practitioner support), PA diaries were inspected alongside PA recordings. The

entries from each week were examined to determine if the participant had increased or made no change (or decreased) activity.

To test if the intervention was associated with increased PA of any type, using the categories of increased or not increased, a chi-square was performed. A chi-square test for independence indicated that there was a significant difference between the intervention and non-intervention group and increasing PA; X^2 (1, N= 67) = 8.2 p = .004, *phi* = .381 which is a medium effect size. The results suggest that those in the intervention condition were significantly more likely to increase PA than those not in the intervention condition. Hypothesis two, that the intervention would increase PA can therefore be supported when self-report measures of PA were used.

5.2.2.2 Walking:

The mean walking scores of participants in each condition are illustrated in figure 5.6 and Table 5.2 and illustrates that, while other groups were levelling out or decreasing walking, the INTSS (practitioner support and intervention group) show increased levels of walking.

Walking means were plotted on a graph (in figure 5.6) for each of the 4 weeks according to the different conditions.

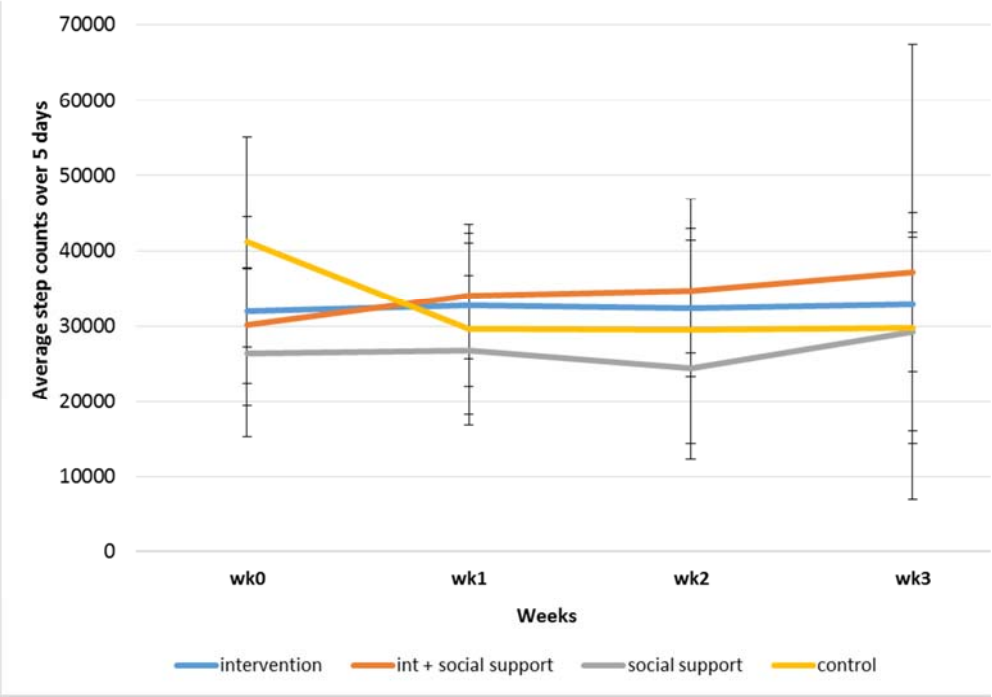

Figure 5.6: Average step counts over 5 days for 4 weeks for all conditions; intervention (INT), intervention and practitioner support (INTSS), practitioner support, (SS) and control (C). Standard deviation error bars for each condition at each time point

An inspection of the mean scores reveals a trend that those in practitioner support (SS) only group were walking at lower levels at all weeks in comparison to the other three conditions. Participants in the intervention and practitioner support group (INTSS) continuously increased levels of walking throughout the four weeks. Those in the intervention and practitioners support group were increasing walking levels per week incrementally, but further examination was needed to determine if these differences were significant.

Table 5.2: Mean step counts and standard deviations (SD) per condition each week and differences between each week and between week 0 and week 3

	***Week 0 Mean** (SD)*	*Steps mean difference wk0 – 1*	***Week 1 Mean** (SD)*	*Steps mean difference wk1 – 2*	***Week 2 Mean** (SD)*	*Steps mean difference wk2 – 3*	***Week 3 Mean** (SD)*	*Steps Mean difference wk 0 - 3*
INT	31924.2	790.0	32714.5	-384.8	32329.7	532.4	32862.1	937.9
	(12499.0)	(7893.5)	(10687.6)	(5133.5)	(9045.7)	(5532.7)	(8860.6)	(11999.3)
INTSS	30100.5	3873.6	33974.25	686.87	34661.1	2466.2	37127.4	7026.9
	(7622.2)	(7314.8)	(8285.9)	(10249.4)	(8261.5)	(34539.4)	(30267.0)	(30423.4)
SS	26447.1	335	26782.2	-2317.38	24464.8	4775.6	29240.5	2793.4
	(11173.4)	(9410.2)	(9948.2)	(6129.4)	(10034.9)	(5062.6)	(13120.4)	(13242.3)
C	41170.6	-3639.9.8	28962.8	1450.4	30882.8	209.1	30967.9	-1980.4.7
	(30360.6)	(5670)	(11152.1)	(8785.6)	(16933.2)	(1046.6)	(15006.3)	(8532.1)

A mixed between-within subject ANOVA was conducted to determine differences of walking across the four weeks of the study and between conditions, to estimate the influence of the intervention and/or practitioner support on walking.

The dependent variable was walking at weeks 0, 1, 2 and 3. The independent variable was condition – intervention, intervention and practitioner support, practitioner support only or control. Preliminary assumption testing was conducted for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity. Box's test for equality of covariance matrices was violated, as the significance value was smaller than .001.

There was no statistically significant difference between condition and time, nor was there a significant interaction effect between condition and time, Pillai's trace = .137, F (9, 132) = .704, p = .705, partial eta squared = .046. There was no significant main effect for time, Pillai's Trace = .029, F (3, 42) = .412, p = .745, partial eta squared = .029. The main effect comparing intervention or practitioner support on walking was not significant, F (1, 44) = .982, p = .410, partial eta squared = 083. This analysis suggests that there was no significant difference in the walking undertaken at each time point in each of the

conditions. Therefore any differences in the walking between groups, is likely to be due to chance rather than the intervention or practitioner support.

Those in the control condition did increase walking at the outset however the scores of walking did not differ significantly from any of the other conditions, and therefore hypothesis five, that the control group would remain unchanged can be largely supported.

Examining the graph and descriptive data, it appeared that outlier/s may exist. On closer inspection one participant in the control group was an outlier. This individual was already undertaking levels of walking over and above those outlined in the exclusion criteria and therefore did not fit the inclusion parameters for this study. The participants data was extracted and the between–within subjects analysis of variance was repeated, however there was no appreciable difference in the final analyses and no significant differences were detected either as a main or interaction effect**.**

As in examination of PBC, collapsing the groups into intervention yes/intervention no and practitioner support yes/practitioner support no, enabled testing with larger cohorts. Two mixed between with ANOVA's were conducted to determine the impact of the intervention on walking and a separate analysis to determine the impact of practitioner support on walking.

Box's test was violated, so Pillai's trace used. No significant interaction effect between time and walking was found, Pillai's trace = .0.66, F (3, 44) = 1.035, p = .386, partial eta squared = .066. There was no significant main effect of time, Pillai's Trace = .018 F (3, 44) = .270, p = .847, partial eta squared = .018. There was similarly no main significant main effect for group (intervention yes or intervention no), F (1, 46) = 2.199, p = .145, partial eta squared = .046.

The same test to examine the effect of practitioner support was undertaken and similarly found that there was no interaction effect between time and practitioner support, Pillai's Trace = .064 F (3, 44) = .999, p = .402, partial eta squared = .064. There was no main effect for time, Pillai's trace = .024 F (3, 44) = .366, p

= .778, partial eta squared .024. There was no significant main effect of group, *F* (1, 46) = .203, *p* = .655 and partial eta squared = .004.

Walking therefore, regardless of condition did not change significantly between pre-test and post-test. The results suggest that neither the intervention nor practitioner support had an effect on walking, and similarly that there was no significant increase that occurred in walking from pre-test to post-test.

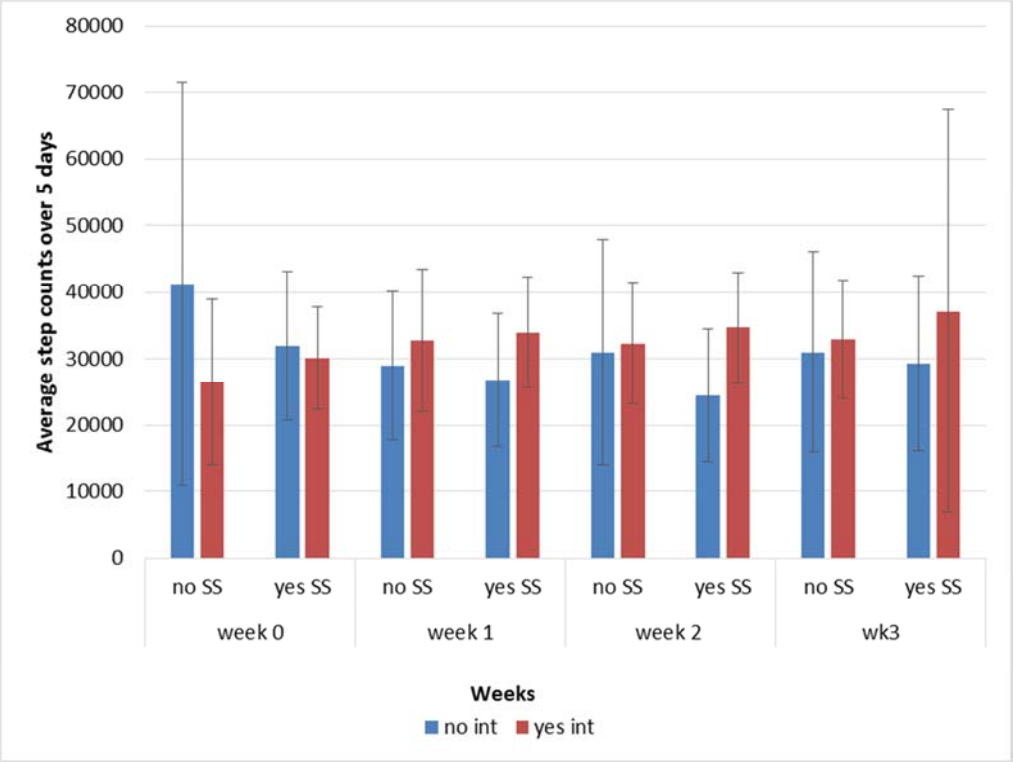

Figure 5.7 Average step count levels over 5 days INT yes/no SS yes/no over 4 weeks; comparing those who received intervention (INT) or no intervention and those who received practitioner support (SS) or no practitioner support. Standard deviation error bars for INT yes/no and SS yes/no at each time point

Hypothesis two, that the intervention would increase PA, can be supported when self-report measures were used, however, where walking was measured by pedometers, the results are non-significant between conditions. Any difference therefore can be attributed to chance. Hypothesis three, that practitioner support would further increase PA over and above that from the intervention, is also not supported by the results, as the differences were not significant. A trend of increasing walking was observed in the INTSS group,

though the differences between this group and other conditions, was not significant. This suggests that despite this trend, hypothesis three, that the practitioner support would enhance PA over and above intervention alone, cannot be supported.

5.2.3 H4: Those who set targets will achieve targets set

Examining the content of the diaries and comparing walking and PA in each week against the targets set out in the plan, 67% of those in the INT and INTSS groups submitted action and coping plans (N = 30). Of these 73% of participants achieved the targets set on at least 1 of the subsequent weeks. The hypothesis that those who set action and coping plan targets will achieve targets set, is supported.

5.2.4 Summary of intervention effectiveness

The results demonstrate that H4, those who set action and coping plans will achieve targets, was supported. Although increases in PBC were detected between pre-test and post-test, this was across all participants in all conditions, and therefore cannot be said to be due to the intervention and therefore H1, cannot be supported. An increase in self-report PA was associated with participants in the intervention condition. There was no significant difference in walking between any of the conditions, therefore the hypothesis (H2) that the intervention would increase PA can be supported where self-report data was used, but not where walking was recorded by pedometers. Those in the INTSS group did show a trend of increased walking but this was not statistically significant from the other conditions and therefore the hypothesis (H3) that practitioner support would increase PA over and above that of the intervention, cannot be supported. Those in the control condition, did not differ significantly from the other conditions, though this group did demonstrate high levels of walking at the outset, suggesting that H5 can be supported.

5.3 Acceptability of intervention

Only those participants (N = 30) who used the intervention were asked a series of questions to assess the acceptability of the intervention.

On a dichotomous scale of agree or disagree, 79% agreed that the HAP tool worked well and an equal percentage said that they would recommend it.

Participants were asked to respond on a 7 point scale; using the Health Action Planning Tool was very effective to not at all effective, very pleasant to not at all pleasant; very easy to very difficult and very fun to very tedious. They were also asked, similarly on a Likert scale of 1 – 7, the extent to which they agreed with the following statements: the HAP tool helped me to ‘make a plan for PA’, ‘ increase the PA that I do’ and ‘think more deeply about the exercise I do’. Participant responses to these questions are provided as means, range, and standard deviations in table 5.3.

Table 5.3 Descriptive statistics acceptability questions

Questions	Minimum	Maximum	*M*	*SD*
The use of the health action planning tool was, on a scale of 1 - 7				
Ease (1= v. easy; 7 = v. difficult)	1	7	2.4	1.8
Pleasure (1 = v. pleasant; 7 = v. unpleasant)	1	6	2.8	1.2
Fun (1 = v. fun; 7 = v. tedious)	1	7	3.2	1.5
Effective (1 = very effective; 7 = very ineffective)	1	6	2.8	1.2
The Health Action Planning tool helped me to: 1 = strongly disagree; 7 = strongly agree				
Make a plan to undertake PA	1	7	5.1	1.9
Think about increasing PA	1	7	5.5	1.8
Increase PA	1	7	5.1	1.9

N = 30 for each statement

20 out of 30 respondents found that the tool was either effective to very effective, and no-one felt the tool was very ineffective. 80% of participants who responded felt that the use of the tool was pleasant to very pleasant. 24 out of 30 respondents found the tool easy to very easy, while 70% participants, said that the tool was 'fun' to 'very fun'.

For each of the questions that asked participants about whether the HAP tool helped to think about PA, increase PA, or plan to undertake PA, the mean response was over 5 in each case, suggesting that participants either agreed, or strongly agreed with these statements.

Appendix 11 presents the results of the acceptability questions in graphical format.

5.4 Qualitative Data Analysis

Participants from the INT and INTSS groups were asked about their experience of the HAP tool:

What did you think worked well?

What improvements/adaptations would you like to see in the HAP tool?

To all groups:

Any other comments you wish to make about this study?

Responses to all questions were open but limited to 450 characters.

Several subthemes emerged from the data analysis including action and coping planning, goal setting, review and feedback, and self-monitoring. Other themes which emerged were support (and practitioner support), as well as intervention improvement.

The analysis of the content primarily revealed that the subthemes largely, though not exclusively, fed into two key themes: motivation and volition; things that would help/were helping, to motivate, and things that would help/were already helping to put things into action. As questions directly asked about the use of the tool and improvements that could be introduced, effectively these two themes were largely contained within those two contexts: intervention improvements and intervention experiences. These were separated for ease, nonetheless, it was also apparent that often a theme that was evident in one, was also evident in the other context. For example, self-monitoring was both perceived as positive but also as frustrating when the self-monitoring tools did not work (i.e. the pedometers). These comments fed into the self-monitoring sub theme of motivation and volition in intervention experience, but a recommendation to improve the feedback from self-monitoring, was a theme in intervention improvement.

The central codes and themes are presented below. The model below attempts to demonstrate the two contexts of intervention experience and intervention improvements. Within each of many sub-themes of such as self-monitoring, and goal setting are represented. Overall, these two general areas feed into the core themes of motivation and volition.

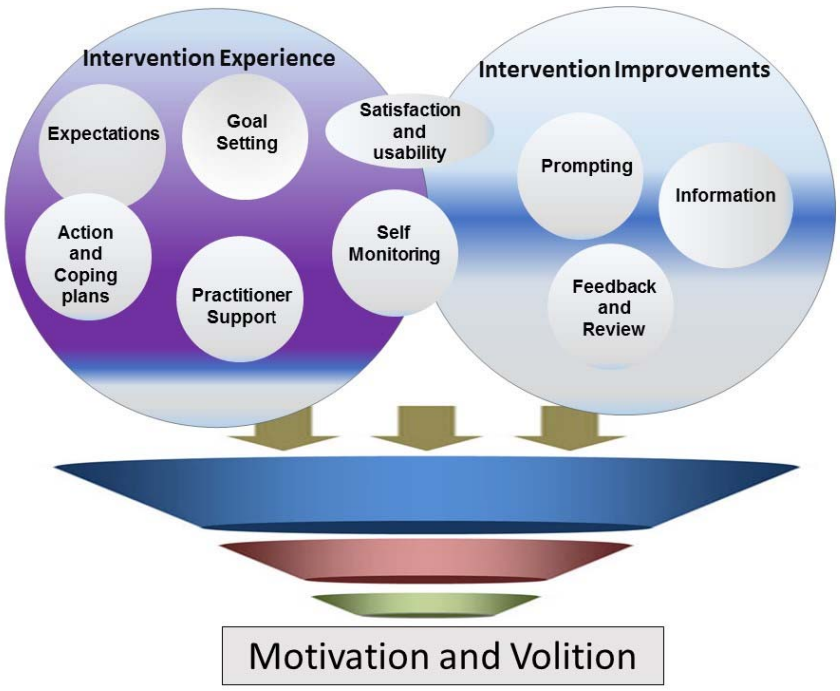

Figure 5.8: Qualitative Thematic Relationships

Although the themes discussed below can be seen as distinct, they are also overlapping, as diagrammatically presented in figure 5.8. The comments indicating intervention improvement were coalesced with intervention improvement comments. Acceptability comments illustrated the benefits of the intervention but also where acceptability could be enhanced through intervention improvements. And these comments in terms of the intervention experiences and improvements could be viewed as contributing towards motivation and volition.

5.4.1 Motivation

As noted above, motivation was a key theme and was embedded within several of the subthemes that emerged. Different aspects of the intervention appeared to motivate individuals.

Although not clear what element is being referred to here, one participant found the experience very motivating for PA engagement:

Gp1 P59: *It made me think more deeply about my engagement in regular, structured, physical activity rather than just drifting*

This motivation may have been an outcome of the self-monitoring or any of the individual techniques that were used to prepare for action and coping planning and increase PBC. Alternatively it is possible that the motivation was a product of information provided at the outset about PA and refers individuals to the government guidelines about PA benefits.

The motivation of the tool was evident for some who were in the control and or practitioner support only conditions, as illustrated in the comment from a practitioner support only participant.

Gp3 P46: *Really helped motivate me to do some regular exercise*

Despite not being in receipt of the intervention, the experience of being part of a study, or being asked questions about PA, the practitioner support, or self-monitoring, was increasing motivation and volition.

5.4.2 Volition

Volition also emerged as a central theme. However it was often difficult to separate out volition from that of intention or motivation. In the case of the participant below however, it is clear that the engagement in PA was very important and intimates that this resulted in a change in attitude as well as behaviour.

Gp3 P53: *Even when I was shattered and stressed, yet i still went for a walk even for 30 minutes, it did change my whole outlook on situations. Thanks.*

As the individual was not in receipt of any intervention, then this change may have been precipitated by an increased salience of PA, emerging from the questions asked, the self-monitoring, or the practitioner support.

5.4.3 Self-Monitoring

A subtheme in the comments was entitled self-monitoring and the comments appeared to demonstrate the value of self–monitoring towards increasing salience of current PA. These comments emerged from participants in all groups, from those who were using the intervention to those who were not, as well as those in the practitioner support only condition and the control condition.

Many of the comments from participants reflected on their pedometer readings and the monitoring of their behaviour. For several participants, this monitoring in itself was seen as a very positive outcome of the study. Some of the participants complained about the lack of accuracy of the pedometer and hence their frustration in using it. Participants wanted to self-monitor but were unable to do so accurately when the pedometers failed, which in itself appeared to influence intention and volition.

When asked what worked well from the intervention, the following participant noted the value of the diary and its motivational value. The recording of steps appeared to create a dissonance between actual and perceived level of activity. The direction in this case, appears to be that the individual was taking more steps than he or she had estimated. By contrast, another individual who was in the control group, appeared to recognise how little activity he or she had been undertaking. In either case, the self-monitoring appeared to be increase dissonance, and this in turn appeared to increase salience of activity and intentions to increase activity.

Gp3 P62*: The diary record of steps taken each day and with which activity. It helps to encourage me that there is a significant amount of exercise in activities that I wouldn't necessarily expect.*

Gp4 P40: *Very interesting to reflect on the pedometer readings. Realising how much time I spend sitting at my desk and how much more I need to work.*

Self-monitoring emerged frequently, in particular referring to the pedometer, in terms of leading to an increased salience and interest in increasing activity.

Gp1 P27*: The best bit? The pedometer. I'm very motivated by technology and knowing how many steps I took made me want to increase it week by week. At the start, I found that on a 'lazy' day I didn't reach 5000 steps.*

Gp4 P18*: I now realise I need to do much more physical activity…. I have enjoyed the small amount of exercise that I have done over the past few weeks and intend to do much more*

Gp1 P61*: Keeping track of my daily steps knowing what could be achieved*

The self-monitoring acted both to raise personal awareness of what has been achieved (or raised concerns regarding minimal activity engaged in) and simultaneously precipitated thoughts about the motivation to undertake PA. The above comments demonstrate the increased interest in intending to increase activity, but self-monitoring also emerged as seemingly instrumental in further engagement in PA, that is, increasing volition.

Gp1 63: *It allowed me to see the huge variations in my daily steps and also to realise how beneficial going for a brisk walk was, which I'd generally seen as fun rather than exercise prior to the study.*

The self-monitoring influence was evident in comments from non-intervention participants as frequently as it emerged from the intervention participants. Self-monitoring was frequently mentioned, as demonstrated above, in relation to either intention and/or motivation.

5.4.4 Perceived Behavioural Control

Despite a lack of statistical significance of the intervention and or practitioner support towards increasing PBC specific, a subtheme of the motivation and volition themes, emerged which reflected characteristics inherent of PBC in the qualitative data. Several comments indicated control (or lack of it) and/or confidence (or lack of it) in undertaking PA and as these concepts can be subsumed by the construct of PBC, this theme was named as such. Positive benefits of control and confidence were noted, with statements of confidence frequently indicating a sense of either achievement or capability:

Gp2 P25: *I felt much better about myself.*

Control statements that were construed as related to PBC, emerged largely when people identified barriers that were either not resolvable and which prevented PA engagement, or they commented that they had managed to successfully overcome barriers. These comments were often in tandem with making plans, though not exclusively so.

Gp1 P54: *I was really enjoing my first weekl but then I feel sick and had to stop. Would like to do it all over again.*

Gp2 P57: It *really made me think about working around the barriers to physical activity caused by the other demands of my lif, rather than thinking I couldn't doo it because of these issues (typically family responsibilities).*

This notion of barriers, is also relevant to the intervention which may have served to raise awareness of how to resolve barriers, in part through the preparatory work for action and coping plans as well as the act of completing an action and coping plan in which they were advised to identify barriers and consider coping strategies to resolve those barriers.

5.4.5 Action and Coping Plans

There were a number of comments that reflected the benefit of making plans and as in earlier subthemes, these contributed to the key themes of motivation or volition:

The intervention was perceived as valuable in the creation of action plans and also supporting adherence and hence contributing to motivation:

Gp1 P51*: Kept me motivated to follow my action plan*

In addition participants also noted the benefits of coping planning:

Gp1 P51*: It was very effective at making me aware of what I was doing ans=d helped me to recognise what stops me exercising and toi work ways around it.*

Gp2 P43: *Reference to the web site, having a plan and a table to fill in. Thinking about how exercise made one feel and recording it also reinforced the fact that sometimes I mean to exercise but don't. In my mind I often think I have exercised because i have thought about it* (in response to the question – what worked well).

As noted above, these statements reflect the perceived positive benefits by participants of creating action and coping plans, and the techniques designed to help to develop robust plans through resolving or mitigating barriers.

Establishing the 'action' from an action plan also emerged as important to undertaking action or volition:

Gp2 P27: *Thinking through what I could change and then seeing if I managed it.*

Gp1 P77 : *How it helped me to write my own action plan*

Gp1 P63: (in response to what worked well: *I think I prefered the physical action plan - I feel like the hap told me what I already knew, as in I feel better about myself if I have set aside time to exercise, however, the physical action plan was hugely useful*

The above statement indicates some confusion as to what is the HAP Tool, but nevertheless the individual points to the value of having a plan, in addition to actually being physically active.

5.4.6 Goal Setting:

Often in the context of a comment on action and coping plans, goal setting was mentioned. Again the comments can be attributed to motivation or volition

Gp1 P75: *Planing out what I was going to to and helped keep to it*

Planning, goal setting, motivation and volition were occasionally presented altogether as in the short statement above. The individual notes the value of

the plan, but the notion that the plan is setting a target that he or she will then aim to achieve if the plan is adhered to.

Writing and submitting action and coping plans is beneficial to achieving a target.

Gp2 P38: *'Some ambiguity in the survey made it difficult for me to answer the questions. For example the tool helped me to increase the amount of exercise I do - because I said I would. That is not a response to the tool'.* In terms of *what worked well,* this participant added*: 'Useful information and my own expectation/ drive to I would complete once I started'.*

Although the participant disputes the value of the tool and instead contends that the increase in PA was due to setting a goal, this goal setting could be attributed to taking part in the study in which they were asked to set a goal.

5.4.7 Practitioner Support:

A few commented on the value of the practitioner support towards motivation, either through the emails, or through the belief that there is someone who is evaluating progress

Gp1 P54: *The idea of it and the tables we had to fill in every week and to know that some one will check it*

Gp1 P47: *Actually, I found Wendy's weekly email very motivating*

5.4.8 Expectations

Comments also indicated that there was a perceived expectation, even from those members of groups 3 and 4 who were not accessing the Health Action planning tool, that they should be increasing PA, and that someone would be checking their data:

Gp4 P47: *An enjoyable, interesting experience. Definitely an aspect of Observer effect (Hawthorne Studies etc) to think about. The fact that I was being part of a*

study in itself had an impact on my inclination to increase my steps. Thanks for the opportunity to do it

Gp3 P29: *Apart from measuring my steps and activity, I didn't really know what I was supposed to do during the study. Was I supposed to increase my activity? If so, there was nothing indicating this, apart from one email from Wendy on the third week.*

Gp3 P65: *i found that I was enthusiastic in week zero and wanted to walk but had to not do any since it was meant to be my typical week. By the time I got to the 2nd week ie week 1 I had lost that initial enthusiasm!*

5.4.9 Satisfaction and Usability

Several comments in response to 'what worked well' suggested that a good level of satisfaction and usability of the tool.

A number of the comments suggested that individuals found the intervention engaging and effective. There is no indication in these comments if the intervention was also effective, only that it was acceptable. Though the final comment where the individual requests further information about the percolation of the pilot, intimates that there is an interest in changing behaviour, but perhaps the interest lies in changes other aspects of behaviour.

Gp1 P24*: All documentation and the Blackboard resources clear and easy to use.*

Gp1 P35: *simple, easy to follow yet effective*

Gp2 P43: *Can I continue to access this plan after the pilot has finished? Is this type of planning to succeed going to be applied to other areas of lifestyle eg healthy eating, studying, depression, organisation, time management, relaxation, etc.?*

In the following comment, satisfaction of the tool was implicit, and the effectiveness of the tool in increasing PA, was more explicit.

Gp1 P35: *thank you! It was good fun, i definitely put more effort into what physical activity I do.*

5.4.10 Intervention improvements

Intervention improvements were suggested in response to a question asking for recommendations. Many of the recommendations made reflected how the intervention could be adapted in a way that would increase intention and volition. Increasing feedback and making that feedback more individual was noted more than once:

Gp1 P24: *Some immediate analysis and feedback on pedometer readings. It should be possible to automate this so that participants see percentage increase/decrease in activity week on week. This would be useful information for self-motivation.*

Again, this need for personalised feedback is demonstrated in the following comment, with the individual identifying a request for personal accomplishments to be recognised, but also for feedback on specific areas where achievements and progress had been made.

Gp2 P43: *I think if the HAP was on a website with a weekly questionnaire - a bit like this one - which could show you diagrammatically how you were doing with bar charts, graphs, pie charts etc, to show you your strengths and weaknesses and how you had improved.*

Other improvements suggested, were in the area of goal setting, with some feeling that it would be easier to achieve smaller goals. The comments below demonstrate the value attached to self-monitoring and goal setting and its relationship to both volition, and motivation.

Gp1 P55: *Making a small change to your normal lifestyle rather than a massive fitness programme which is really hard to adjust to*

Gp1 P20: *Maybe a long term plan as well as weekly one, so not too discouraging if don't manage weekly one, e.g. due to illness, can still achieve long term aims.*

Gp4 P28: *I felt the pedometer did not count my steps correctly at the beginning of this study due to where on my waist I clipped it on, I found that by placing it completely onto one side helped take a more accutate count by picking up my steps better.*

Some participants noted the disruptions of exams and holidays.

Gp2 P62: *Perhaps the timing of the study was not the most suitable for me with all the essays and exam prep I had to deal with simultaneously as it was end of semester. However, having a house to renovate at the same time, maybe countered some of that and gave me something*

Comments such as these suggest that barriers to participation in PA, were still over-riding intentions. Individuals were not able to exert control over these events to engage in PA.

In sum, qualitative findings of this study demonstrate themes primarily of intention and volition to increase PA. Intervention experience and intervention improvements overlap with several themes reflecting the actual techniques used, such as the use of self-monitoring devices and diaries, goal setting, action and coping planning, and practitioner support. Where suggestions were made about improving the intervention, these were often in relation to action and coping planning or goal setting in ways that increase feedback and review.

Table 5.4 Summary of outcomes of hypotheses testing and research question

	Hypothesis	Result of testing
H1	The intervention (techniques to increase PBC and action and coping plans) will lead to increased levels of PBC.	Not supported
H2.	The intervention will lead to increased levels of PA measured through pedometers and self-completed diaries	Supported in relation to self-report PA data only, not supported when pedometer data used for analysis
H3.	The intervention and practitioner support will lead to increased levels of PA over and above that achieved by those in receipt of practitioner support or intervention only	Not supported, though PA in intervention and practitioner support group approximating clinical significance levels
H4.	Those who set targets will achieve targets set.	Supported, those who set targets associated with increased PA
H5.	Walking and PA for those in the control group will remain unchanged.	Supported, though control increased walking in week 0 , differences were non-significant
	What was the acceptability of the internet intervention and practitioner support and what improvements would render it more acceptable?	Acceptability was positive and themes suggest that the inherent techniques were valued in increasing motivation and volition

Chapter 6: Discussion

This study examined the efficacy and acceptability of an online intervention to increase PA and PBC. Despite the appearance of a trend of increased walking for those who were in the intervention and practitioner support condition, analysis of results revealed that walking was not statistically different between conditions. Those in the intervention group were more likely to increase PA than those who did not and importantly, there was a significant association between setting own personal PA targets and achieving these targets. PBC increased across all participants regardless of condition.

In order to be tested with sufficient power to achieve meaningful results, this study required 120 participants. Although this number initially signed up for the study, those who ultimately completed fell short of this. The quantitative data therefore needs to be interpreted in the light of this shortfall. Even where the statistical analysis neared significance levels, these significance levels must be considered with caution as necessitated by the limited power of the study.

This chapter will discuss the quantitative and qualitative findings in relation to the original hypotheses followed by a discussion of the strengths and limitations of the current study and the contributions to existing literature. Recommendations for future research and intervention delivery follows based on the analysis of the results within the context of the evidence base.

6.1 Efficacy of the HAP intervention

The efficacy of the intervention to increase PBC, and of the intervention and practitioner support to increase PA, was tested through comparing the outcomes of PA and PBC between conditions. Participant action plans and PA were examined in order to test whether plans set, were achieved.

6.1.1 H1: Efficacy of intervention to increase PBC

In a comparison of the pre and posttest results of the PA TPB questionnaire there was a significant increase in PBC at post-test. However, this change was across all completers and in scrutiny of the results, there was no significant difference between conditions. The hypothesis cannot be supported as it was not the intervention per se that can have increased PBC, given that the scores were elevated across all groups.

These results were unexpected, given that the techniques used here have been employed elsewhere to good effect in increasing PBC (Darker et al., 2010). This earlier study (Darker et al., 2010) was delivered by the researcher, and results may be influenced by this potential bias, and hence in a replication of the study, it was delivered by a broader range of practitioners (French et al., 2012). Similarly positive results were observed using the techniques, but restricting measurement of the TPB constructs to self-efficacy rather than PBC.

However, self-efficacy as a single item construct examining confidence (Armitage & Conner, 2001) omits control and ease (Bandura, 2004). It is possible that self-efficacy responds more easily to SE enhancing techniques. The measurement of self-efficacy in lieu of PBC, may explain the disparity between the results here, and those obtained by the replication study (French et al., 2012). These results refresh the PBC-SE debate, and in particular question whether PBC is a necessary pre-requisite for behavior to change. If SE is the more effective leveraging construct, perhaps revision of the TPB model is required.

To explain the overall increase in PBC observed here, a number of factors may be worth considering. It may be possible, first of all, that the TPB PA questionnaire was not reliable (Fen & Sabaruddin, 2009). The questionnaire, however, had a high internal reliability equivalent to values of TPB questionnaires used elsewhere (Giles et al., 2007), suggesting that it was adequately measuring the incumbent constructs. The questionnaire was designed on the basis of the results from elicitation and piloting of the questionnaire (see Appendix 4) and as such, should be able to account for the variance of beliefs and cognitions in this population (Francis et al., 2004).

It is perhaps feasible that the techniques themselves were not effective in increasing PBC, despite their positive outcomes in previous studies (Darker et al., 2010; French et al., 2012; White et al., 2012). Or that the techniques were not effective over and above the effects of participation in the study. Qualitative data suggests that study participation may have been instrumental to increasing a sense of confidence in undertaking PA: '*Really helped motivate me to do some regular exercise*' and '*I was very surprised to see how much I do actually walk*'. These comments were made from participants in the control and practitioner support only conditions respectively, who were not in receipt of the motivational and volitional techniques. Nevertheless it is apparent that they were experiencing an increased confidence and motivation towards PA engagement. In which case, participation in the study may have been operating to increase PBC, while the techniques themselves, may not have been sufficiently robust, or required a longer time frame (French et al., 2012) in which to increase PBC over and above the noise of participation.

The function of mastery (Bandura, 2001) could explain the overall increases in PBC and the impact that participation may have had on all individuals in this study. The activity of self-monitoring of behaviour provides feedback to the individual of successfully performing it, in other words, of mastering the behaviour (Hardeman et al., 2011). In effect this information provides self-efficacy reassurance. This is not dissimilar to what has been described as a 'response shift' (Liebreich et al., 2009) whereby 'self-perception and internal standards' (p 13) adapt in line with behavioural transformations. Rather than the cognitions precipitating behavioural changes, the direction of change is in the opposite direction and behavioural change facilitates cognitive change (Liebreich et al., 2009). This shift is not a reliable one as demonstrated by Hardeman et al. (2011), when increases in PA did not lead to more positive changes in cognitions for a sample who were sedentary and 'at risk' of diabetes.

Participants here, in contrast to the Hardeman study (2011), were from a general population, albeit from one institution and had agreed to participate in a

PA study. This agreement may also have primed participants to be cognitively prepared for engaging in PA irrespective of condition grouping (Armitage, 2005). Without this preparedness, it would seem unlikely that the participants would have been motivated to sign up (Richardson et al., 2010). The very nature of being 'prepared' to participate, alongside the self-monitoring, may have provided the situations in which mastery of a behaviour may develop. These shared characteristics by all participants may have inadvertently rendered the whole cohort more homogenous in relation to their beliefs about their capacity to participate in PA.

Another potential consideration is that the cohort PBC increases witnessed here, could be attributable to inherent characteristics of the sample population. In a study to examine the intention-behaviour relationship and the PBC-behavioural relationship for leisure time PA, Amireault and associates (2008) found that age and financial income were the strongest moderators. A younger population could conceivably be more transient in their routines rendering the intention–behaviour relationship less reliable (Amireault et al., 2008), though their study sample only stretched to 26 at its lower age range and measured leisure time PA according to bouts of 30 minutes, 3 times a week. For those who are younger, PA is rarely sustained for periods longer than 5 to 10 minutes (Armstrong, 1998). It is feasible that age of participants may offer some explanation for the unpredicted increases overall in PBC in the current study. The population here consisted of over 20% in the 18 – 25 age bracket and comments identifying the pressure of exams do reflect fluctuating lifestyles. With respect to the increased levels of income, Amireault and associates (2008) contended that being more financially comfortable could potentially be associated with cognitive beliefs that barriers were more easily surmountable. Income bracket was not assessed in this study, however it is feasible that given the substantial proportion of staff, as opposed to students in the sample, income may be at levels where this belief may be operating and, which may provide some rationale for the generalised increase in PBC.

While PBC increased across all conditions, another unexpected cognitive change in this study, was that of intention, which decreased, again across the full cohort. While intention was not targeted specifically in the techniques in this study, nevertheless, increasing PBC is theoretically construed in the TPB as having a direct relationship with both behaviour and intention (Ajzen, 1991). An increase in PBC therefore would be expected to have a concurrent increase in both intention and behaviour (Hagger et al., 2002). However, the TPB does not consistently operate as expected (Sniehotta, 2014) and this inconsistency is feeding the debate about the value of the TPB to health behaviour intervention research (Conner, 2014; Ogden, 2014; F. F. Sniehotta, Presseau, & Araújo-Soares, 2014) which will be discussed in further detail below.

Apart from the lack of congruence with the TPB model, the results observed here of intention decline, could be attributable to initial high hopes of individuals that may have been precipitated by signing up for a PA study. This optimism is analogous to the notion of '*false hope syndrome*' where individuals may have high self-efficacy and high expectations of the outcomes of health behaviour change at the outset of a study which can dissipate as the activity is undertaken (Anderson-Bill, Winett, & Wojcik, 2011; Polivy & Herman, 2002). An initial high walking score by those in the control group may be an indication that even those who were not in receipt of the intervention were commencing the study with enthusiasm which did dissipate.

There are therefore, a number of explanations that could account for the increase in PBC witnessed across all conditions in this study. Participation in a PA study, inherent characteristics of the population, or measurement of PBC or SE, could each separately or conjointly be partially responsible. It is of course, feasible that the TPB model itself requires revision, and this view is not dissimilar to concerns voiced previously (Chatzisarantis & Hagger, 2005; F. Sniehotta, 2009). The appropriateness of the TPB as a model of behavioural change will be considered in further detail below.

6.1.2 H2: The efficacy of intervention to increase PA

It was hypothesised (H2) that those individuals who were in receipt of the intervention would increase PA more than participants who did not. When the data was coded dichotomously to distinguish between whether people increased or did not increase PA, there was a significant difference between the conditions, and those in the intervention condition were more likely to increase PA. This coding was based on clinical significance criteria applied to the PA data. The hypothesis therefore that the intervention increased PA is supported in relation to self-reported PA data, but is not supported by the walking data alone.

It is possible that the significant findings in the PA diaries but not in the pedometer readings, is an artifact of the different types of recording. Self-report data can be more prone to error than that of pedometers which are considered to be more accurate and objective (Ainsworth et al., 2014; French et al., 2012). Similarly it has previously been demonstrated that the TPB can account for greater levels of variance when self-report rather than objective monitoring is used (Armitage & Conner, 2001) suggesting that objective monitoring can be more conservative.

Reflecting on the significance borne out of the PA self-report data, the intervention techniques appear to have been successful in facilitating PA behavioural increase. It is difficult to determine if the results here have been consistent with previous studies as PA TPB informed intervention results have been mixed and there is limited use of these interventions in online delivery formats making comparison difficult.

As discussed earlier, the use of these techniques have been shown to be effective in a face-to-face walking intervention (Darker et al., 2010) though no baseline measurement of walking was undertaken. Analysis was undertaken on results from mid and posttest data only. If baseline walking levels were high, this may question whether the walking levels measured later in the study were truly a reflection of the intervention. In the current study, these weaknesses were avoided by ensuring that baseline figures of PA were recorded as well as mid and posttest recording and measurements used were

both objective pedometer recordings alongside more subjective self-report measures. This precaution of measuring at all-time points, leads to somewhat more confidence that the behavioural change here was in relation to the techniques used.

In a replication of the Darker et al. study (2010) (French et al., 2012) in which baseline measures were undertaken, differences in steps were evident only after a longer time frame (T3 – three weeks after baseline). At shorter periods (T2 – two weeks after base line), all participants in all groups were walking more than they had at T1 which is not atypical in some PA TPB intervention studies (Kinmonth et al., 2008). This suggests that change within shorter time periods may be a product of participating in a study rather than as a consequence of the intervention, and this explanation could similarly be applied here in relation to the walking figures.

The above studies delivered techniques face-to-face; in an online PA TPB delivered intervention, no PA or cognition change was observed however only action and coping plan techniques were used (Skår et al., 2011) and as noted earlier, techniques for both motivation and volition may be required to elicit change (Scott et al., 2007). Again using an online delivery mechanism, (Spittaels, De Bourdeaudhuij, Brug, & Vandelanotte, 2007), used information tailored to both the stages of change (Prochaska, DiClemente, & Norcross, 1992) and mapped to the constructs of the TPB, and found no difference in PA between those in the personalised versus standardised advice format. Increased PA across the full cohort as here was observed, and this may indicate that the TPB intervention was effective but personalised information is not required. Though the manner in which the TPB was operationalised in the techniques is unclear, making it difficult to draw any firm conclusions about the relationship between the techniques in the Spittaels et al. (2007) study and this current study.

Altogether, variable previous results and delivery formats render comparison of the current study with other literature, difficult. It is apparent that TPB informed interventions can be effective in increasing PA (Darker et al., 2010; French et

al., 2012; White et al., 2012). However, more consistency in the measurement of outcomes and adherence to the TPB is required to facilitate a greater quantity and quality of previous studies to determine the efficacy of the TPB to increase PA. Similarly, a longer time frame may reveal results which are independent of the confounding factor of study participation. Increased PA in this study was positively associated with the intervention and the hypothesis can therefore be partially supported suggesting that the techniques were operating effectively to increase self-reported PA.

6.1.3 H3: The efficacy of intervention and practitioner support to increase PA

The differences in mean levels of walking between the four conditions did not differ significantly, though a trend of increased walking was observed in the intervention and practitioner support condition. When analysis was applied specifically to see the effect of practitioner support, the results were not significant. Those who were in receipt of practitioner support only, undertook the least number of steps and their activity was reasonably static over the four week period. The hypothesis (H3) that the intervention and practitioner support will lead to increased PA over and above intervention only condition is therefore not supported.

While the differences in walking between those in the intervention and practitioner support group from the other conditions were not statistically significant, mean level of steps of the intervention and practitioner support group increased 23% from pre to posttest, while the practitioner support only group increased by 11% and the control group decreased by 24%. Hence, a positive trend of increasing walking in the intervention and practitioner support group was observed, while walking by the practitioner support group remained relatively constant and walking by the control group appeared to be diminishing.

Improvement to health can be achieved with as little as 4,300 steps/day (Tudor-Locke & Bassett, 2004) and/or 3,000 over baseline (Clemes et al., 2010) though others suggest that much lower levels of 1,000 steps can have marked

health improvements (Warburton et al., 2006). Clinical significance has been recorded as 1000 – 2000 steps (Richardson et al., 2007). The intervention and support group increased from a mean of 30,000 steps to approximately 37,000. As such, although statistical significance was not achieved, it could be argued that the observed increases in walking of individuals in the intervention and practitioner support group, were beginning to reach levels at which positive health impacts may be gained. Incrementally increasing activity slowly but consistently, can minimise risks of injury created by setting large goals, and is also more likely to lead to greater self-efficacy and durability (Richardson et al., 2010; Warburton et al., 2006).

The pedometer readings illustrated that clinical significance was approximated. While these figures are of interest, the hypothesis that intervention and practitioner support would lead to increased PA, cannot be supported due to the lack of statistical significance of walking between each of the conditions. Based on the observed trend of increased levels of walking in the intervention and practitioner support group, the intervention and support may have been operating symbiotically where PA change was being precipitated albeit not to a level which was significantly different from the other conditions. This presents the possibility that practitioner support was influencing PA increase over and above that offered solely by the intervention, but that a longer time frame may be required for these differences to be significant (French et al., 2012).

The novel combination of techniques incorporating action and coping planning, support and PBC enhancing techniques, render comparison of the outcome of this study, with other literature, difficult. An additional challenge is the diverse range of characteristics which have been used to define practitioner support, particularly when the support is delivered in an online intervention (Barak, Klein, & Proudfoot, 2009; Fuller, Stokes, & Mathews, 2012; Ritterband & Tate, 2009).

In this study for example, practitioner support was operationalised as one email per week with a motivational message, whereas previous walking interventions have also used community support (Richardson et al., 2010) where the contact is much more variable and difficult to standardise. Other online interventions

have used a range of messaging types and message content (Collins et al., 2012; Jennings, Vandelanotte, Caperchione, & Mummery, 2014). In a study undertaken focusing on the outcome of weight loss, the support condition included personalised and tailored feedback which could also escalate to a telephone call if no data was entered by the individual in any given week of the programme (Collins et al., 2012). The tailored feedback may have been as influential as the support, however these two techniques were not examined separately. In an online TPB PA intervention (Spittaels, et al., 2007) additional support in the form of email messages directed individuals to a website for further information about the stages of change matched to the individual but revealed no significant differences in PA between conditions. Separating out the influence of the additional website and the accuracy of the stage of change matching, from the influence of support only, may have provided more precise information about the influence of support.

Qualitative results here suggest that the additional use of emails, were perceived as supporting motivation and volition Gp1: *Actually, I found Wendy's weekly email very motivating'.* Nevertheless, it is also difficult to determine if this perceived support translated into PA behaviour and to determine any relationship specifically with sedentary behaviour. In internet intervention research, results suggest that where support features have been incorporated in the form of email, text or other online communication, effects can be greater (Bennett & Glasgow, 2009; Murray, 2012; Webb et al., 2010) and attrition levels lower (Mohr et al., 2011). It is possible that by increasing the dose-response, understood as the number of contacts made, that a greater increase in PA change may have been observed as has been muted elsewhere (Davies et al., 2012; Greaves et al., 2011), though the optimum level of contact remains obscure.

In sum, the walking results show a positive trend in this study suggesting that the intervention and practitioner support were together having an effect. The walking results were bordering on clinical significance however, were not statistically significant. It is possible that significant change would be detectable

only over longer time frames, as observed in other studies (e.g. French et al., 2012) and only once confounding variables such as study participation has dissipated. Importantly, the digital delivery model used in this study marks it as unique from much of the previous TPB PA intervention studies and it is possible that this in itself may be a confounding influence on the PA and PBC results. Internet interventions which have incorporated support have been far from unanimous about the manner of operationalising and measuring support and hence how and whether, it contributes to behavioural change (Micco et al., 2007; Webb et al., 2010). A more stringent analysis of the specific leveraging aspects of online practitioner support, is required. Future studies for example, may be able to determine if the frequency of emails, or tailoring of content to specific ambitions and achievements, may lead to increased efficacy of the intervention (Davies et al., 2012). Tailoring is discussed in more detail below.

6.1.4 H4: Participants who set targets will achieve targets

The results illustrated that of the 67% of eligible participants who submitted action and coping plans and who also submitted a minimum of 2 weeks of PA diaries, 73% achieved their self-set targets. This result suggests that setting targets is conducive to achieving these goals.

These results are in accordance with the literature where making both action and coping plans is a necessary component required to bridge the gap between the motivation for a behaviour and behavioural enactment (Araujo-Soares et al., 2009; Luszczynska, 2006; F. F. Sniehotta et al., 2006). Recent evidence suggests that such is the importance of planning to the outcome of behavioural change, that interventions should incorporate techniques to increase adherence to planning (Mistry, Sweet, Latimer-Cheung, & Rhodes, 2015). Planning to initiate a new behaviour and identifying the environmental and social cues that can elicit that activity increases the potential to resist and replace the habituated behaviour with the goal (de Bruijn, 2011; F. F. Sniehotta et al., 2005). In a systematic review examining the efficacy of coping plans (Kwasnicka et al., 2013) it emerged that coping plans used in conjunction with action plans

resulted in greater effects, which is in line with findings in this study. These observations would not have been detected, without the examination of the content of the action plans alongside the diaries. This examination is unique in this literature where action plans and coping plans have previously been measured with whether a plan has been made or not (Araujo-Soares et al., 2009b). Scrutinising the plans revealed the detail of what individuals aimed to achieve. Through examining these alongside the self-report data, it was possible to code the data according to whether participants had achieved or did not achieve their targets.

The goals set by participants in some cases were moderate, so for example targets were '*swim for 30 minutes twice a week'* '*increase average steps/week by 500*' '*increase steps next week by 1000'*. It is possible that in a trial of a longer duration, participants would continue to incrementally increase PA (French et al., 2012). Small changes over longer time frames have greater chance of success (Norman et al., 2007) and are also recommended to establish durability of behaviour change (Araujo-Soares et al., 2009b; Hardeman et al., 2011).

6.1.5 H5: No change is expected in PA levels in the control group

The control group undertook greater levels of walking at baseline and at week one than the other groups which though unusual, is not unique (Freak-Poli, Wolfe, Backholer, De Courten, & Peeters, 2011). Control groups may not be immune from experiencing effects from study participation (McCambridge & Kypri, 2011; West et al., 2008).

Qualitative data revealed that participants in the control group were feeling motivated at baseline which echoes conclusions reached elsewhere that self-monitoring and questionnaires may precipitate increased awareness of PA (Freak-Poli et al., 2011; Hardeman et al., 2009). However, it is interesting that this effect was not more evident across all conditions. McCambridge and Kypri (2011) in a meta-analysis and systematic review of studies which ask questions about health behaviour, revealed that the simple task of answering questions can result in a behavioural change through increasing salience in the behavior

being questioned. While this factor may be operating here, it is not at all clear why this was having a more profound effect on the control condition, and primarily over one week. It is feasible, given that the largest decrease in walking over the period of study was observed in the control group, individuals in the other groups were subsequently benefitting from the intervention and practitioner support combined.

Every effort was made to ensure that the control group was blinded to the intervention and support techniques, but the activities of self-monitoring (Michie et al., 2009) and PA questionnaire completion (Godin, Bélanger-Gravel, Amireault, Vohl, & Pérusse, 2011) may have influenced behaviour. It is also possible that while control groups act to provide a comparative analysis, there can be a presumption on the part of researchers that members of a control group will maintain a status quo (West et al., 2008). The assumptions that individuals in the control group will be untainted by attrition, treatment and conversely that the participants within the conditions received the intervention in the form in which they were intended, is a weakness of RCT research (Sanson-Fisher, Bonevski, Green, & D'Este, 2007). While the use of an internet delivery can facilitate standardised delivery of an intervention and hence fidelity of delivery (Glasgow et al., 2004), lack of adherence to instructions in online deliveries is not unusual (Skår et al., 2011; Kwasnicka et al., 2013). There was no assessment undertaken of whether individuals received, read and used the intervention in this study. It is feasible that some intervention participants may not have opened and used the intervention contents and hence their experience of participating in the study may have been more similar to that of control participants.

Future studies should seek to distinguish the effects of the techniques of the intervention separately from study participation (Godin et al., 2011). Similarly a measurement asking participants to 'recall' aspects of the intervention (Spittaels et al., 2007) may be useful to evaluate whether the intervention was not only read but understood, as a means of distinguishing the experience of those in the intervention condition from that of the control group.

6.2 Intervention Acceptability

The efficacy of the intervention was mixed, however acceptability of the intervention, drawn primarily from the Likert questionnaires and qualitative data was generally very favourable. Participants found the tool very effective, easy, fun and pleasant. The majority (55%) of participants would recommend the tool and 79% said that it worked well. Responses to questions about whether the HAP tool enabled participants to make a plan, think more deeply about PA or increase their levels of PA, were very positive, suggesting that the majority of participants agreed or strongly agreed with these statements.

Key themes that emerged throughout the qualitative data were motivation and volition. Participants recorded that they felt both motivated to engage in PA, as well as increased their engagement in PA, by the techniques of action and coping planning alongside goal setting and practitioner support. Techniques of self-monitoring, identifying barriers and finding ways to resolve barriers were perceived as contributing to target setting. Similarly participants also recorded that they found the techniques of target setting, self-monitoring and coping planning precipitated intentions to increase PA. These themes affirm the value of the techniques used in both facilitating motivation and volition of PA.

Some improvements or adaptations to the website were recommended by participants. Respondents noted that the improvements would help to sustain and encourage PA behaviour, details of which are discussed in further detail below.

The acceptability results are comparable to those found elsewhere in PA internet interventions (De Cocker, Spittaels, Cardon, De Bourdeaudhuij, & Vandelanotte, 2012; Vandelanotte & De Bourdeaudhuij, 2003). Consistent with earlier acceptability results in PA intervention literature, where this has been evaluated, acceptability has not reliably converted into significant PA change (Heideman et al., 2012). Given that recommendations were suggested for intervention improvements, future research should determine if incorporating these suggestions would be reflected in positive PA increases.

6.2.1 Intervention Recommendations: Feedback and Tailoring

Qualitative data made recommendations for future adaptions and many of the suggestions referred to the provision of personalised (tailored) feedback alongside progress plotting of self-monitoring data. These propositions mirror conclusions drawn elsewhere in the literature, of the benefit of tailoring and feedback, in eliciting behavioural change (Cugelman, Thelwall, & Dawes, 2011; De Cocker et al., 2012; S. L. Williams & French, 2011).

Feedback is particularly important at early stages of behavioural change to build a sense of competency or mastery of the behaviour in question (Bandura, 1997). Providing regular feedback or reward specifically targeting small successes rather than an overall behavioural target can also increase effort (Williams & French, 2011; Vandelanotte et al., 2007) and assist in the development of the necessary skills to ultimately self-regulate (Armitage, 2005; Abraham et al., 1998). Previous uses of feedback in walking interventions have been successful in increasing satisfaction (Richardson et al., 2007) and where specific goal-related efforts are reverberated in feedback, greater effect size is witnessed (Lubans et al., 2007). The benefits of frequent feedback also extend to minimising attrition in online interventions (Joseph, Durant, Benitez, & Pekmezi, 2014). In this study, while feedback was used, it was minimal and the literature and qualitative data results illustrate that this is a point for future research consideration.

In addition, the tailoring of messages, that is, personalising messages based on previously gathered information about individual characteristics and specific health outcomes (Noar, Benac, & Harris, 2007) can be facilitated by internet interventions (Carr et al., 2008; Lustria, Cortese, Noar, & Glueckauf, 2009; Neville et al., 2009). Tailoring has been shown to be efficacious in other studies of this nature (Neville et al., 2009).

Despite extensive use of tailoring in internet interventions however, studies have not been homogenous in terms of the characteristics used, ranging from psychosocial mediators (van Stralen, de Vries, Mudde, Bolman, & Lechner,

2011), TPB constructs and stages of change (Spittaels et al., 2007), cognitive determinants alongside local information of PA opportunities (Prins et al., 2011), perceived benefits and barriers, readiness to change and self-efficacy (De Bourdeaudhuij et al., 2010) as well as pedometer readings (de Cocker et al., 2012). Meta-analysis and systematic reviews of tailored interventions have struggled to isolate the effective operational mechanisms, and hence the effective constituent parts of the tailored message are still somewhat obscure (Krebs, Prochaska, & Rossi, 2010; Lustria et al., 2009; Neville et al., 2009; Wanner, Martin-Diener, Bauer, Braun-Fahrländer, & Martin, 2010).

This study did not use tailoring and yet it seems that this technique can be effective and that individuals in this study would welcome the addition. It is apparent that further research is required to examine the theoretical foundation of the tailored messages alongside the dose, duration, design and mode of delivery (Foster et al., 2013; Neve, Morgan, Jones, & Collins, 2010; Webb et al., 2010) and to establish which of these mediators reliably facilitate behavioural change in PA.

6.3 Strengths and limitations of the study

The intervention in this study focused on two main approaches to leverage PA change; enhancing PBC and creating action and coping plans. While PBC increased, this was across the full cohort and thus not attributable purely to the implementation of the intervention techniques or practitioner support. The qualitative data established that action and coping plans are perceived as valuable to achieving goals alongside the techniques used to be able to create robust plans. Categorical data corresponded by illustrating that of those who submit plans, a large proportion do meet self-set goals. PBC did not increase as a consequence of the intervention and/or social support. The overall increase of the full cohort may be a product of a confounding variable (Hardeman et al., 2009), an indication that the intervention was not effective, or that a longer time frame (French et al., 2012) was required.

There was a significant association between increased PA and being in the intervention groups. Walking measured by pedometers did increase in the intervention and practitioner support group and the difference, though not significant was reaching clinically significant levels (Richardson et al., 2007). The short duration of the study, the use of self-monitoring by all participants and the preparedness of participants for PA engagement on signing up, are all potential confounding variables which will be discussed in more detail below as will the particular contributions that this study makes to the PA internet intervention literature.

6.3.1 Strengths

This study examined an intervention as one independent variable composed of techniques to enhance PBC and planning techniques to increase PA. It did so in a two by two factorial design using practitioner support as the other independent variable. By using the internet for delivery of both the intervention techniques and support, it was possible to maintain a standardised delivery, and by examining the content of action and coping plans, it adopted a novel to detecting behavioural change. The study therefore added new insights into the

TPB PA internet literature. The following sections examine the strengths and limitations in more detail and are followed by a set of recommendations.

6.3.1.1 Measurement of Action and Coping Plans

One of the most conspicuous contributions of this study to the literature has been the unique examination of the content of the participant action and coping plans and diaries. In earlier studies, participants have been required to indicate whether or not they had made plans (Luszczynska, 2006; Skår et al., 2011). While this information is useful in establishing if there is a relationship between the act of making a plan and a behavioral change, it does not provide detail about what participants aim to achieve and how this relates to the behavioural outcomes. Critically, this study demonstrates the value of examining the content of the plans themselves, which intimates that change may be small but in accordance with personal goals. Two-thirds of the participants in the intervention conditions in this study achieved the goals in the plans that they submitted. These goals contained critical information which under examination alongside diaries revealed the extent to which the goals set were achieved in the succeeding weeks. Scrutinising the goals, and whether participants achieved targets set, is an important dimension of this research which had previously been neglected.

6.3.1.2 Internet Delivery

Another important dimension of this research was the use of the internet to facilitate the delivery of the intervention. The use of computer technology in this study was perceived at the outset as one of the significant benefits of the 'reach' of the intervention (Bennett & Glasgow, 2009). The invitation to participate in the study was distributed across the whole geographical spread of the Highlands and Islands to over 2,500 students studying at Scottish Credit Qualifications Framework levels 6 – 12, in addition to a large number[2] of administrative, lecturing and managerial staff. Hence, simply as a means to

[2] The numbers of staff and temporary staff in the UHI is not currently available due to the nature of overall governance of the institution.

disseminate the invitation to participate, technology was valuable and this has similarly been reported in other studies (Aalbers et al., 2011)

The digital delivery also enabled the intervention to be static and therefore consistently adherent to the intervention protocol. This goes some way to addressing the concerns about fidelity to intervention delivery and poor reporting of intervention components raised by some authors (Ashford et al., 2010; Greaves et al., 2011; Rhodes & de Bruijn, 2010).

6.3.1.3 Study Design

Another strength of this study was the use of two independent variables, an intervention and practitioner support, and thereby using a 2 x 2 factorial design. The PA results revealed a significant association between intervention and increases in PA; clinical significance of walking was approximated only in the condition whereby participants experienced both the intervention and practitioner support (Richardson et al., 2007). The 2 x 2 factorial design facilitated the opportunity to examine the effect of the combination of variables.

6.3.2 Limitations of the current study

There are a number of limitations that may account for some of the results in this study, and/or provide recommendations to where future research should be directed.

6.3.2.1 Internet delivery examination

The internet delivery was a strength of this study, as noted above, but may simultaneously have been a limitation. This study did not set out to examine the influence of the internet delivery mode. By keeping each of the conditions constant apart from the specific independent variables of practitioner support and intervention, the internet delivery mode should not have been more influential on one condition more than any other. Nevertheless, not examining

the mode of delivery may have been at the cost of assessing if it exerted a confounding influence.

The rapid pace of technological development along with an extensive range of design options in internet interventions results in a digital landscape which is constantly evolving (Foster et al., 2013; Strecher, 2007). This increases the challenge in terms of isolating the effective characteristics of web based interventions further compounded by limited and imprecise reporting in manuals as well as heterogeneity of use (Krebs et al., 2010; Lustria et al., 2009; Neve et al., 2010). The consequence has been a general oversight in isolating and maximising, the effective elements of the delivery mechanisms in the literature (Webb et al., 2010). Future research should seek to ascertain the exact components that are engaging the user – issues to do with dose-effect; social networking forums, and other communication channels such as chatrooms and emails and the extent to which online interactivity is influential (Aalbers et al., 2011; Donkin & Glozier, 2012; Neve et al., 2010).

6.3.2.2 Attrition

While attrition figures in the submission of action and coping plans need to be taken into account (33% failed to submit action and coping plans) this level is considerably lower than has been recorded by other e-health interventions (Skår et al, 2011). The higher rate of submission may be in part attributable to the weekly email contact with participants, whereby participants were reminded or 'pushed' to submit plans and/or diaries and to adhere to plans constructed (Chiu & Eysenbach, 2010; Eysenbach, 2005). Nevertheless, lack of submission of plans and diaries represents a limitation in this study. The difficulties in ensuring adherence to instructions are not unusual (Donkin & Glozier, 2012; Slootmaker, Chinapaw, Seidell, van Mechelen, & Schuit, 2010). Precautions on the extrapolation of the results should be noted based on the limited number of completing participants, which may have led to overall less robust data. Future studies should aim for greater numbers at study outset to ensure greater power taking account of the high levels of attrition that can be witnessed in internet interventions (Chiu & Eysenbach, 2010).

6.3.2.3 Participant Characteristics

Examining the participant characteristics of past behaviour, gender, location, occupation, age and TPB variables using a binary logistic regression, detected no significant differences between those who continued with the study and the drop outs. It is nonetheless worth considering whether specific properties of the sample population not examined, may have contributed to the results. The failure to isolate any effects of PBC in this study for example, was similarly shared by Hardeman et al. (2009) in a study of PA amongst sedentary individuals. Hardeman and colleagues attribute this failure in part to the potential immutability of the population of sedentary participants. However, this rationale is not applicable here, where the participant sample was from a non-clinical population. The TPB operates less well in predicting cognitions and behaviour in a student population (Amireault et al., 2008)

Nevertheless, the participants in this study were all current students and/or members of staff at single institution. This suggests that they are a less heterogeneous group at the outset, and questions whether results can be generalised to other populations (Hardman, 2011; Armitage, 2005).

Drop out data is not available for those who received information but did not pursue the study any further and it may be possible that those who were not interested in PA and had less positive attitudes and lower PBC about PA, elected not to progress (Chui & Eysenbach, 2010; Wanner et al., 2010). Future studies should seek to examine the characteristics of those who choose not to participate in PA intervention investigations and similarly to access participants from a wider pool.

6.3.2.4 Expectations of Participants

As in many studies distinguishing the effects of the intervention from the effects of social desirability (Armitage & Conner, 2001; de Bourdeaudhuij et al., 2010; Hardeman et al., 2009) can be challenging. The chance that participants may have been attempting to make assumptions about the outcomes of the study

and adapt their behaviour to fulfill anticipated expectations of the study cannot be disregarded (Skår et al., 2011).

When participants signed up for the study they received the pedometers to ensure that they knew how to use them and that they were working effectively. Despite precautions to ensure that participants were randomly allocated and blinded to the different conditions, it was evident that many of the participants were motivated to commence PA regardless of the instructions and intervention they received. This is revealed in the qualitative data from a participant in the practitioner support only group '*i found that I was enthusiastic in week zero and wanted to walk but had to not do any since it was meant to be my typical week. By the time I got to the 2nd week ie week 1 I had lost that initial enthusiasm!'*. This expectation by the participant may have been because the act of self-monitoring precipitated an increased salience and interest in PA (Abraham, et al., 1998), or simply asking questions and raising awareness of PA stimulated interest and motivation in behavioural change (Godin, Sheeran, Conner, & Germain, 2008; Hardeman et al., 2009; McCambridge & Kypri, 2011).

The effects from participation in the study and self-monitoring of PA may have masked the impact of the intervention and practitioner support, by serving to raise levels of awareness and hence intention and PBC for PA. This is not unique in studies where self-monitoring is employed (Lubans et al., 2009). The change in cognitions of the whole cohort may also have obscured an effect of the intervention alone (Hardeman et al., 2009).

High levels of walking by the control group at baseline were not maintained in subsequent weeks. In a study examining a PA intervention, De Bourdeaudhuij et al. (2010) proposed that a similar decrease emerged only in those participants who were already meeting the government guidelines at baseline and that participants may have assumed that they were therefore undertaking sufficient PA. Control group participants here commenced with 41,000 steps over a 5 day period and may have believed this to be close to the government target. Others have contended that a ceiling effect may be operating (Franko et al., 2008; Liebreich et al., 2009) whereby individuals believe they have

expended their maximum effort, and this may account in part for the minimal increase of PA in the intervention groups as well as the decrease by the control group.

6.3.2.5 Self-Monitoring

Another feature that may have influenced the results, was the inclusion of monitoring as a measurement outcome for those not in the intervention conditions, but which was simultaneously being used as a technique, and which appears to also be operating motivationally across the cohort (Greaves et al., 2011). Self-monitoring in itself can act motivationally as well as having a reverberating effect on volition by providing the individual with evidence of competency in the activity (Bandura, 1994; Sniehotta et al., 2005; Warren et al., 2010). Self-monitoring may also dispel myths about current activity; Slootmaker et al. (2010) contend that inactive people may be unaware that they are inactive. Self-monitoring therefore may set up an uncomfortable dissonance between what an individual believes that they have been doing in contrast to the actual measurements. This is evident in the qualitative data: *Very interesting to reflect on the pedometer readings. Realising how much time I spend sitting at my desk and how much more I need to work.* The information gained from self-monitoring led to the uncomfortable realisation of limited activity engagement. Individuals may have been motivated to reduce this dissonance by taking appropriate action (Abraham et al., 1998: Armitage & Connor, 2001; Michie & Abraham 2004).

Monitoring behaviour emerges from many studies as one of the key mechanisms of increasing awareness and adapting cognitions towards a behaviour (Conn, Hafdahl, Minor, & Nielsen, 2008; Lubans et al., 2009; Pearson, 2012). It has been isolated as an effective intervention component in several health behavior change interventions alongside other intervention techniques (Greaves et al., 2011; Michie et al., 2009). If used in isolation however, the effects of self-monitoring may extinguish over time (Bravata et al., 2007; McMurdo et al., 2010). Again, longer time frames for the study would be advisable for the future to ascertain the value of the other techniques to

increase and sustain an increase in PA and distinguish the effects from self-monitoring alone.

There is a tension therefore, between setting up a robust study which incorporates the recording of daily achievements, in opposition with the inherent effect that the very act of gathering data from participants may have on subsequent behaviour and cognitions (Lubans et al., 2009). Self-monitoring to record outcome measurements used here by all participants regardless of condition, may have been acting in a confounding manner.

6.3.2.5a Pedometers:

Extensive use of self-report data has been cited as leading to a risk of falsely over-inflating the predictive utility of the TPB (Hardeman et al., 2002). To counteract concerns, this study used pedometers for objective data collection in addition to self-report diary data; nevertheless, the reliability of the pedometer instruments was questionable.

Some of the pedometers were replaced due to device problems. Future studies may be advised to use more robust pedometers or indeed accelerometers whereby the recording of activity can be blinded from participants (Tudor-Locke et al., 2006). As noted above, pedometers may also confound results due to the potential of increasing salience and motivation (Conn et al., 2008). Using blinded accelerometers would have the added advantage of potentially extracting the effects of self-monitoring from the effects of the other intervention techniques.

6.3.2.5b Diaries

Another form of self-monitoring used in this study was diary keeping. Participants were required to maintain PA diaries and pedometer readings on five days out of seven. The daily requirement may have been viewed as even more taxing than undertaking PA and may have led to the failure to submit diaries and/or withdrawal from the study (Warren et al., 2010).

While there may have been an element of diary fatigue (Wiseman, Conteh, & Matovu, 2005), it is conversely also another form of self-monitoring with similar motivational consequences to that which has already been discussed above (Greaves et al., 2011). As also noted earlier, differentiating the impact of self-monitoring from intervention effects is advisable and the use of an accelerometer which records activity discretely and objectively, may be warranted (Lubans et al., 2009).

6.3.2.5c Analysis of Diary Data

There was no restriction on the type of PA that participants could pursue in this study. Lower acceptability of interventions has been associated with goals being set by the study rather than by allowing free choice (Richardson et al., 2007). Similarly by not prescribing any specific activity, individuals may be able to maximise the use of local resources rather than be restricted by environmental barriers (Saarloos, Kim, & Timmermans, 2009).

However, by allowing flexibility of choice, the PA data collected through diaries was more challenging to analyse. MET (metabolic equivalent) calculations can be established through estimating the consumption of oxygen in healthy adults (Wanner et al., 2010). However using MET calculations can be compromised if participants are classified as obese (Wanner et al., 2010) and have not consistently been found to be reliable against objectively measured data (Hendelman, Miller, Baggett, Debold, & Freedson, 2000) approach used here, was to record time spent and number of days alongside pedometer readings. This method of using self-report of PA and objective measurements has previously been demonstrated as being concordant forms of data (Irvine, Gelatt, Seeley, Macfarlane, & Gau, 2013). Similarly self-report behavioural data has been found to be reliable (Webb & Sheeran, 2006) though as noted earlier, this view is not unanimous (Armitage & Conner, 2001). The data recorded was then categorised into ‘increased’ or ‘not increased’ based on criteria for clinical significance (Richardson et al., 2007); or achieved, did not achieve in relation to original targets set out in action and coping plans. This dichotomous approach, though providing greater flexibility of PA pursuit, may have compromised more precise analysis.

6.3.2.6 Possible influence of IPAD Reward

Participants in this study were entered into a prize draw for an IPAD. This 'chance' of winning may have acted as a motivational factor confounding the results. Incentivisation requires more extensive examination and is the current focus of a systematic review (O'Malley, Baker, Francis, Perry, & Foster, 2012); there is little reference in the literature of the influence from a reward of the same financial magnitude as an IPAD. Largely, rewards cited in the literature are more conservative (e.g. 25 euros in Spittaels et al., 2007), and further analysis of this potential impact is required (Pearson et al., 2011).

6.3.2.7 Possible limitations of TPB

In PA interventions, where theory has been used as a rationale to specify the behavioural determinants, those which draw on self-regulatory principles have often emerged as more effective (Araujo-Soares et al., 2009; Armitage & Conner, 2000). In a review of PA and dietary reviews by Greaves et al. (2011), the authors concluded that those interventions employing self-regulatory informed techniques had higher rates of effectiveness in both dietary and PA outcomes (2011). The results are consistent with the literature in other behavioural domains in revealing that techniques drawing on the principles of self-regulation are associated with greater effects (Hardeman, Griffin, Johnston, Kinmonth and Wareham, 2000; Michie et al., 2009).

According to Ajzen (1991) the TPB is informed by self-regulatory principles which contend that individuals employ a feedback loop in order to sustain homeostasis; physically, cognitively and affectively (Bandura, 2005). By drawing on principles of the social cognitive theory (Bandura, 2005), Ajzen (1991) proposed that individuals perform a cognitive self-regulation, whereby they strive to iteratively evaluate and monitor current behaviour against anticipated outcomes of a particular objective.

However, increasingly questions have been raised which challenge whether the model is indeed a self-regulatory theory of behaviour rather than a linear one

(de Ridder & de Wit 2006; Sniehotta et al., 2014). And further, whether it is capable of predicting anything more than intention (Sniehotta et al., 2009).

In order to compensate for the intention behaviour gap, the extended model used here and elsewhere, incorporating action and coping plans has previously been used to good effect in PA intervention research (e.g. Darker et al., 2010; French et al., 2012; White et al., 2012). Indeed Ajzen himself, noted that the model embraced 'sufficiency' (2011, p1119), that is, that it was capable of incorporating additional constructs that would enhance its predictive and explanatory power. However, a substantial range of variables have been used to augment the model and there is as yet, no clear indication as to which of these variables accounts for the greatest variance in respect of any given population, condition, or behaviour (Rhodes & Dickau, 2012). A systematic review has previously attempted to illuminate the manner in which the model works to predict different behaviours in different populations (McEachan et al., 2011), though the application of this approach in intervention research remains obscure.

The results here as elsewhere may signal a need to either revise the model or use an alternative theory that can predict behaviour with greater consistency and provide more clear guidance on intervention design (Sniehotta, 2014). While some call for the model to be abandoned (Ogden, 2014; Sniehotta 2014) others recommend that the model is not discarded but rather revised and that it retains, sufficient value to continue to be of use (Conner, 2014).

Chapter 7: Conclusions and Recommendations

This study set out to examine the efficacy and acceptability of an online intervention designed to increase PBC and PA. The design of the intervention was based on previous evidence of predictors of PA behaviour (Armitage & Conner, 2001) and the most effective techniques with which to moderate those factors (Ashford et al., 2010; Darker et al., 2010; French et al., 2012; Hardeman et al., 2005; Michie et al., 2009).

Of those who submitted action and coping plans, 73% achieved targets set. One of the most notable contributions to the literature that this study has made was to establish the value of examining the targets set out in action and coping plans in relation to the behavioural records. Previous interventions had recorded action and coping plans simply by noting that they have been made, or not been made (Araujo-Soares et al., 2009; Skår et al., 2011). Through the analysis of targets and PA records, it was possible to determine that participants make moderate goals and achieve these goals through making small behavioural changes. These changes may have passed undetected given the lack of statistical significance between the pedometer readings of each group had the measurement simply been recorded dichotomously. The potential for greater endurance of smaller, incremental changes over more substantial ones (Norman et al., 2007), gives some confidence that with a longer time frame, these changes might continue to mount (Araujo-Soares, et al., 2009b).

Those who used the intervention were significantly more likely to increase PA than those who did not, which is commensurate with previous literature for PA interventions which incorporate both motivational and volitional techniques (Araújo-Soares et al., 2009; Darker et al., 2010; French et al., 2012; Sniehotta et al., 2006). Examining the outcome measure of walking only, the practitioner support and intervention group achieved greatest levels at weeks two and three, though, the differences between this condition and the others was not at a significant level.

The positive trend observed in the walking undertaken by the intervention and practitioner support group, suggests that this technique should be examined

further. Factors such as dose-response, as well as the nature of practitioner support, including who delivers the message and the content of the message deserve further scrutiny to establish the relationship to behavioural change (Webb et al., 2010)

PBC cognitions did increase, however this was across all conditions and not limited to the intervention groups. This increase may be due to the self-monitoring activity (Greaves et al., 2011) and/or participation in a PA study, either of which may have increased PA salience (Armitage, 2005; Hardeman, et al., 2009).

Greater distinction in the outcomes of each condition may have been observed if the study was pursued over a longer time frame, when the effects of the intervention and social support may be more manifest over and above the potential influence from, PA questionnaire completion and study participation (French et al., 2012; Hardeman et al., 2011; Kinmonth et al., 2008; McCambridge & Kypri, 2011). Similarly, isolating the effects of self-monitoring may help to explain its relationship with the other techniques. Nevertheless, the results of this study suggests that the value of PBC as a predictive construct of behavioural change may need to be revisited and adds to a growing body of literature seeking to reflect on the TPB as a suitable behavioural change model in its current form (Sniehotta et al., 2014; Kinmonth et al., 2008; Armitage et al., 2005; Rhodes & Dickau, 2012).

The key themes emerging from the qualitative data were motivational and volitional and reflect the theoretical perspectives of this study. The HAP tool and the practitioner contact were both seen as contributing to motivation but also contributing to action. As noted above, self-monitoring appeared as a core concept within both of these themes and reflects literature identifying self-monitoring as a leveraging technique in behavioural change (Greaves et al., 2011; Michie et al., 2009).

The level of acceptability of the study was high and participants purported the value of the intervention and agreed that they would recommend it to others and that it helped them to think about more deeply about, and undertake more, PA.

Recommendations based on the lessons learned from the achievements and limitations of the study will be useful for future iterations:

- The use of PBC enhancing activities and action and coping planning are together valuable, but to isolate the contribution of each of the techniques, they may need to be studied independently.
- Use of accelerometers blinded to participants in one group and compared to the use of pedometers in separate condition would assist in determining the influence of self-monitoring
- The value of flexibility of choice for PA pursuit was substantial in this study, however it is important to explore different methods of measuring PA data
- Practitioner support and personalised feedback and guidance and the specific properties of each, may benefit from being studied in isolation in order to determine their respective influences
- Comparing the use of the internet with face to face delivery would assist in determining the extent to which there may be a confounding influence to the significant detriment of the outcomes

Despite limitations, this study has added to the knowledge and understanding of the efficacy and acceptability of an online TPB PA intervention. Recommendations for future study capitalise on the both the strengths and limitations of the current study.

As a final post script, this research has led to substantial interest in further development and application of the HAP Tool into use for health services. A request for the tool to be modified for use by dieticians at a Scottish Health

Board was made. They requested a development of the tool that would focus on behaviours of healthy eating and PA. In particularly they wished to access a tool that could be used in a blended fashion so that parts of the tool could be administered by the dietician during a consultation and that the client would still be able to access the tool in-between consultation periods. The objective was to provide a tool that would use language that supported collaborative consultations and used techniques that could facilitate health behaviour change. A second objective was that the continual use by the client in-between consultations would help to maintain engagement with the techniques and act as a prompt. The work on this tool is ongoing.

Further development of the tool or variations of the tool within the health service are currently being pursued with interest being garnered following a presentation at the Medicine2 conference in London, 2013 and in particular at a talk presented in Edinburgh in 2014 to digital industries as part of the D Health.

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affiliations of the task force members are listed in the front of this supplement and at www. thecommunityguide. org. 2Address correspondence and reprint requests to: Peter A. briss, MD, community guide branch, centers for disease control and prevention, 4770 buford highway, MS-K73, atlanta, GA 30341. E-mail: PBriss@ cdc. gov. *American Journal of Preventive Medicine, 22*(4), 73-107.

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Appendices

Appendix 1: Behaviour Change Taxonomy (Abraham & Michie, 2008)

Table: Definitions of 26 BCT's & Illustrative Theoretical Frameworks & use in HAP tool

Technique	Definition	Intervention component *	Wk delivered
1. Provide information about behaviour health link.	General information about behavioral risk, for example, susceptibility to poor health outcomes or mortality risk in relation to the behaviour	√	1
2. Provide information on consequences.	Information about the benefits and costs of action or inaction, focusing on what will happen if the person does or does not perform the behaviour	√	1
3. Provide information about others' approval)	Information about what others think about the person's behavior and whether others will approve or disapprove of any proposed behavior change		
4. Prompt intention formation.	Encouraging the person to decide to act or set a general goal, for example, to make a behavioral resolution such as "I will take more exercise next week'	√	1
5. Prompt barrier identification.	Identify barriers to performing the behavior and plan ways of overcoming them	√	1
6. Provide general encouragement.	Praising or rewarding the person for effort or performance without this being contingent on specified behaviors or standards of performance	√ (SS)	1 and 2
7. Set graded tasks.	Set easy tasks, and increase difficulty until target behavior is performed.		
8. Provide instruction.	Telling the person how to perform a behavior and/or preparatory behaviors		
9. Model or demonstrate the behaviour	An expert shows the person how to correctly perform a behavior, for example, in class or on video		
10. Prompt specific goal setting.	Involves detailed planning of what the person will do, including a definition of the behavior specifying frequency, intensity, or duration and specification of at least one context, that is, where, when, how, or with whom.	√	1
11. Prompt review of behavioral goals.	Review and/or reconsideration of previously set goals or intentions	√	2
12. Prompt self-monitoring of behavior.	The person is asked to keep a record of specified behavior(s) (e.g., in a diary)	√	0, 1, 2, 3
13. Provide feedback on performance.	Providing data about recorded behavior or evaluating performance in relation to a set standard or others' performance, i.e., the person received feedback on their behaviour.		
14. Provide contingent rewards.	Praise, encouragement, or material rewards that are explicitly linked to the achievement of specified behaviors		
15. Teach to use prompts or cues.	Teach the person to identify environmental cues that can be used to remind them to perform a behavior, including times of day or elements of contexts.		
16. Agree on behavioral contract.	Agreement (e.g., signing) of a contract specifying behavior to be performed so that there is a written record of the person's resolution witnessed by another	√	
17. Prompt practice.	Prompt the person to rehearse and repeat the behavior or preparatory behaviors	√ (S)	1 , 2
18. Use follow-up prompts.	Contacting the person again after the main part of the intervention is complete	√	2, 3
19. Provide opportunities for social comparison.	Facilitate observation of nonexpert others' performance for example, in a group class or using video or case study		
20. Plan social support or social change.	Prompting consideration of how others could change their behavior to offer the person help or (instrumental) social support, including "buddy"systems and/or providing social support	√	1 , 2
21. Prompt identification as a role model.	Indicating how the person may be an example to others and influence their behavior or provide an opportunity for the person to set a good example		
22. Prompt self-talk.	Encourage use of self-instruction and self-encouragement (aloud or silently) to support action		
23. Relapse prevention. (relapse prevention therapy)	Following initial change, help identify situations likely to result in readopting risk behaviors or failure to maintain new behaviors and help the person plan to avoid or manage these situations		
24. Stress management (stress theories)	May involve a variety of specific techniques (e.g., progressive relaxation) that do not target the behaviour but seek to reduce anxiety and stress		
25. Motivational interviewing	Prompting the person to provide self-motivating statements and evaluations of their own behavior to minimize resistance to change	√	1
26. Time management	Helping the person make time for the behavior (e.g., to fit it into a daily schedule)	√	1

***SS = Practitioner support condition**

Appendix 2: Participant Information and Consent Form

Health Action Planning Tool (HAP)
Participant Information Sheet Phase 3

Invitation paragraph

Thank you for taking the time to read this form. Physical Activity is one of the target behaviours that the UK government seeks to increase. Physical activity guidelines have been issued by the government about the amount of physical activity that people should achieve in any week. This level of activity has been set on the basis of evidence which shows it can help to protect people from certain diseases such as coronary heart disease, stroke and diabetes.

What is the purpose of the study?

We are interested in determining if a health action planning tool will support people to make physical activity plans and pursue those plans.

Why have I been invited?

We have sent this invitation to all staff and students at the UHI. We require participants who:

- Are between the ages of 16 and 65 and do not have a condition which puts you in chronic pain or limited mobility.
- Do not currently undertake 30 minutes of exercise 5 times a week. If you are already undertaking this level of exercise, then we thank you for your time, but cannot use you in this study.
- Do not have a physical or mental health condition which prevents them from participating in regular physical activity
- Who can access groupwise email and blackboard virtual learning environment (all UHI staff and students)

Do I have to take part?

No it is voluntary and up to you to decide. If you do decide to take part, your contribution will be valuable. All participants who complete the study will have their names added to a prize draw for an Apple IPAD which will be drawn at the completion of the study

How much time is involved?

This study will involve very little time. You will complete questionnaires which will take approximately 10 minutes in the first and the third week. For three weeks you will access some information online that should take you no more than about 15

minutes to complete each week. You will then record your physical activity over a three week period. See the table below for further information.

Where will the study take place?

All the communication will take place through the online virtual learning environment Blackboard. We will also contact you either through during the study by mobile phone or email – whichever is most convenient to you

When will I be required?

The study will operate over a four week period (see the timetable below. We need all participants enrolled by the middle of March**.**

What will happen to me if I take part?

If you agree to take part in this study you will be asked to do the following:

Week 0:

- You will be given a participant number and assigned to one of four groups
- You will complete two questionnaires:
  - A physical activity questionnaire about the amount of physical activity you currently engage in
  - A questionnaire about your beliefs about physical activity
- You will be issued with a pedometer to measure your daily walking
- You will be issued with a physical activity diary to record your activity
- You may also wish to ask any additional questions
- You will be given information about how to access your online programme
- You will provide the research assistant with your preferred means of contact (email or mobile phone)

	Group 1 Hap	Group 2 C	Group 3 HapS	Group 4 S
Week 1	• Accessing online information • Record physical activity levels • Devise an action plan for physical activity	• Accessing online information • Record physical activity levels	• Accessing online information • Record physical activity levels • Devise an action plan for physical activity	• Accessing online information • Record physical activity levels
Week 2	• Accessing online information • Record physical activity levels • Review action plans	• Accessing online information • Record physical activity levels • Devise an action plan for physical activity	• Accessing online information • Record physical activity levels • Review action plans	• Accessing online information • Record physical activity levels • Devise an action plan for physical activity
Week 3	• Accessing online information • Physical activity questionnaire • Beliefs about physical activity • Review action plans	• Accessing online information • Record physical activity levels	• Accessing online information • Physical activity questionnaire • Beliefs about physical activity • Review action plans	• Accessing online information • Record physical activity levels
	Name drawn for the IPAD winner			

What are the risks of taking part in this study?

There are no risks. All care will be taken in protecting your information. All information which is collected about you during the course of the research will be kept strictly confidential Any information about you which is disseminated will have your name and any other distinguishing information removed so that you cannot be recognised from it. All information will be stored in a locked cabinet or a password protected document. You may choose to drop out at any point. You do not need to answer any questions that you would rather not answer. This study is being conducted in accordance with the strict guidelines of the British Psychological Society as well as the University Ethics Committee of the University of Highlands and Islands. Your rights as a participant to withdraw, at any point, without penalty, are ensured.

What are the benefits of taking part?

The results of the study will be used to establish whether the health action planning tool can help people to form action plans and pursue them. If it is useful, it will be adapted to use in a wide variety of settings. You will be able to keep your pedometer for future use and your name will be added to a prize draw for an Apple IPAD.

What will happen to the results of the study?

A report will be generated from the study which may result in a publication; there will be no information in this which will identify you.

Who is funding the research?

The research is being funded by a grant from Skills for Health

Who has reviewed the project?

The study has received approval from the UHI Research Ethics Committee. It has been submitted as part of the doctoral work of Wendy Maltinsky.

Who can I contact for more information?

Wendy Maltinsky wendy.maltinsky@inverness.uhi.ac.uk
Principal Researcher Telephone: 01463 273291

Thank you for taking the time to read this information

Please complete the participant consent form below. Save a copy of this information and send a copy to Wendy Maltinsky

.....

Participant Consent Form

Name

Contact Details: E-Mail: Phone Number Mobile Phone Number

I am between the ages of 18 – 65 ☐

I do not currently undertake exercise for 30 minutes 5 times a week on a regular basis ☐

I do not have a condition in which I am in chronic pain or have limited mobility ☐

I have read the participant information sheet ☐

I understand that I can withdraw from this study at any time ☐

I understand that no information will be used to identify me ☐

I understand that I am not required to answer any questions that I choose not to ☐

I agree to take part in this study and understand that I can quit at any point ☐

Appendix 3: Intervention Manual

Metadata	Do not manually edit this table.
Title	Health Action Planning
Keywords	health, behaviour, goals, action plans
Description	A resource to help you make changes to your health
Author	wendy maltinsky
Organisation	Inverness College

Action planning for health

Hello and welcome to the action planning for health site.

This is the start of a journey towards your goals.

This site is designed for people who are considering making changes to the physical activity they undertake.

What this site will and will not do:

This site will help you to form physical activity goals and will assist you to monitor your progress towards those goals.

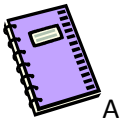
X This site is not designed to **make** you change your life.

X It will not force you to plan some health goals nor to stick to them once your have written them.

But, if you have been thinking that you want to make some changes to your health and you would like some support in how to do so, then you may find this site useful.

You will require the following –

A document on your computer – or if you prefer to use paper and pen, then this is fine.

 A notepad and pen

 A calendar / diary

Busting the Myth – Physical Activity – it's not all about running!

Increasing physical activity is much easier than you may have thought.

You can increase your physical activity by choosing something you are already doing and doing more of it – increasing the steps you take and measuring it using a pedometer.

You can increase your physical activity by choosing something you really like doing and setting a plan to do it regularly – going swimming twice a week rather than once.

You can also increase your physical activity by choosing to do things differently like taking the stairs rather than the elevator, walking briskly around the shops in the shopping centre or dancing while you hoover the carpet.

All of these activities count as part of your physical activity which protect or increase your health and minimise your health risks.

Continue on to the section below for information on physical activity and physical activity guidelines.

Physical activity - It's not all puffing and panting

Physical activity has been shown to help people to feel better generally both physically and emotionally. Getting enough physical activity can help to reduce your chances of getting diseases such as heart disease and diabetes? 

And, it can also be fun 

But how much is enough?

Government guidelines suggest that we need:

5 periods of moderate physical activity of 30 minutes each time

You don't have to do the 30 minutes all at the same time.

You can start in small chunks of 10 minutes at a time and build up gradually at your own pace.

Small changes are more successful than big changes

Building even just short 10 minute physical activities into your day will start to have a health benefit.

Moderate Activities
(I can talk while I do them, but I can't sing.)

Ballroom and line dancing
Biking on level ground or with few hills
Canoeing
General gardening (raking, trimming shrubs)
Sports where you catch and throw (baseball, softball, volleyball)
Tennis (doubles)
Using your manual wheelchair
Using hand cyclers—also called ergometers
Walking briskly
Water aerobics

Vigorous Activities
(I can only say a few words without stopping to catch my breath.)

Aerobic dance
Biking faster than 10 miles per hour
Fast dancing
Heavy gardening (digging, hoeing)
Hiking uphill
Jumping rope
Martial arts (such as karate)
Race walking, jogging, or running
Sports with a lot of running (basketball, hockey, soccer)
Swimming fast or swimming laps
Tennis (singles)

The link below will take you to the US Department of Health and Human Services 'Be active your way' Factsheet. Please use the back button to return to this page.

The gym is not the only answer

Many people say that they cannot bear the gym and that this prevents them from getting exercise. But physical activity is not just about going to the gym. Here are a few ideas:

Go for a walk at lunchtime

Try to increase the number of steps you take every day gradually.

Go for a bike ride

Go to a salsa dance class

Dance as you hoover the carpet

Swim

Get off the bus a stop or two early and walk to your destination

Take the stairs at work.

If you work near the top of a building, take the lift and get off a floor or two early.

If you work at a sedentary job, get up and walk around the building every hour for 10 minutes making sure you take at least one flight of steps each time.

Walking Guidelines

Walking is simple, free and one of the easiest ways to get more active, lose weight and become healthier.

It's also sociable,

Boosts your immune system for 24 hours

You're probably doing it already

It strengthens bones and muscles

I can lower stress

Regular walking has been shown to reduce the risk of chronic illnesses, such as heart disease, type 2 diabetes, asthma, stroke and some cancers.

A 60 kg person burns in 30 minutes:

Strolling (2mph) 75 calories

Walking (3mph) 99 calories

Brisk walking (4mph) 150 calories

How do I know how many steps I'm taking?

The average person walks between 3,000 and 4,000 steps per day, and **1,000** steps is the equivalent of around **10** minutes of brisk walking. Use your pedometer to check how many steps you are walking.

How many calories will I burn if I walk 10,000 steps a day?

You'll typically use between 300 and 400 calories by walking 10,000 steps. For sustainable

weight loss, you should aim for a calorie deficit - that is, more calories used than consumed - of around 600 calories per day.

How fast should I be walking?

The key to walking to improve your health is to walk briskly. When you walk briskly you should still be able to speak and should not be out of breath, but you should feel slightly warm and be breathing a bit faster than when you are sitting.

Remember: You don't have to do all of your walking in one period of time. Look for as many opportunities as you can to do a bit of walking. You can do some walking in 10 minute periods, and over even shorter periods of 2 – 3 minutes. You may be able to fit in longer walks at different times of your day or week.

Let's move on to the next page to start thinking about physical activity and how it can fit into your life.

How much are you walking?

The first thing you should do to work out how to increase your physical activity is to check out how much you are currently doing.

How much physical activity are you currently doing? Have a look at your physical activity diary from Week 0

Use your pedometer to help you work out how much walking you are currently doing. Practice using it and make sure you know where to position it.

Find your starting step count.

Round the record of your walking form the 5 days from week 0 to the nearest 500.

This is your starting step count.

The next step is to think about what changes you can make to increase your physical activity either by doing more of what you are doing already, or doing additional activities, or simply by increasing your step count.

Small Changes

People who make plans are more successful in making changes than those who do not make plans. Making a plan to make even a small change can make a big difference to your health both now and in the longer term.

Let's start by focusing on a specific area of physical activity.

Choose one activity below that you feel would fit most easily into your life and that you would most like from the agenda chart below, or think of an idea of your own.

You choose?

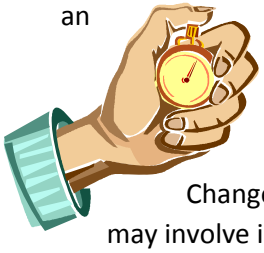
What physical activity are you interested in pursuing? Write it down in your notebook (or document).

Good, now that you have decided, turn to the next page and you will be starting the process of making small changes.

Small Changes

It is important to make only small changes at a time.

For example, there is no point in deciding that you will go to the gym 6 times a week for an hour each time if you have never been there before. People can struggle to make big changes such as this.



Changes that are most successful are ones that can fit into your life easily. They may involve increasing the time, pace or frequency of something you already do. Maybe you already walk 4000 steps a day. You may find it relatively easy to increase that by 1000.

Let's have a look at what some other people have said:

'I love skiing, but I know that it's unrealistic to build it into my life on a regular basis, but I do think I could use the stairs more often.'

'I already walk to the bus stop to go to work, but I will try to walk to the next stop in future.'

Benefits and difficulties of making a change

Making positive lifestyle changes can have many benefits. So increasing your physical activity will have positive benefits to your health (though it is always best to consult your doctor if you are planning any major changes – another reason why making small but consistent changes are often more beneficial). But you may also feel that making positive changes carries some disadvantages as well.

The prospect of changing can be scary.

More often than not people feel a bit ambivalent or in two minds about the behaviour that they are thinking about changing.

So for example, when I think about trying to increase my physical activity, I know that it requires me to give up an hour of my Friday evening to spend at the gym instead of going home to relax.

But on the positive side I know that I have put on a lot of weight and that it is having an impact on my health. My snoring is driving my husband out of the bed and I am out of breath when I climb the stairs. Being more fit, will make me feel better physically, but I also feel generally less stressed when I am being active. I also tend to feel more capable….. able to take on the challenges of work and home.

People are much more successful about making changes when they have thought about how they will cope with the difficulties of making that change and thought about how they will cope with missing aspects of the behaviour they are going to change.

For example

I really would like to be able to wear the clothes I used to before I had children but I love my food…. So then I start thinking, I know, I could exercise more but I just find it too hard to find time to walk, and I don't have an exercise bike and the gym isn't open when I am available. . . .

Changing *wishing* to do something to actually *doing* it means that you have to think about what's really important to you and the difficulties you may face on the way **and** how you will deal with them.

Look at the list below created by some previous participants to gain some ideas. In the column on the left are the challenges or difficulties they thing they will face and the column on the right are the positive approaches they have chosen to tackle these difficulties.

Challenges	Ways of managing
When others are expecting me to do things for them, I will find it hard to prioritise exercising.	I will make a set time on 4 days to start with, during which I am going to walk out of the house to do some exercising regardless of what else is happening. I will let my family know so that they can work out their demands on me around that
I want to walk more but don't have a pedometer	I will take the same route every week and then the following week, I will walk another 10 minutes – that's another 1,000 steps.
I know that I could walk to work but on the days I have a lot to carry, I won't want to walk.	I am going to invest in a wheelie bag for carrying my work and aim to walk at least 3 days a week to work. I am also going to make sure that I take the stairs at least 4 times a day rather than the lift.

These challenges and ways of managing them are important to think about if you are going to turn your plan into action.

What will be some of the things that you will find difficult when you change your behaviour? In your notebook draw a chart such as the one above. Write down the challenges in the column on the left and put ideas for how you will manage them in a column on the right.

You have undertaken an important step in making changes.

Confidence in making changes

It's important to explore your confidence about increasing your physical activity.

You will have made other changes in your life before or have achieved things that you were not sure that you thought you could do before you started. Think about something in your life that you have achieved. It doesn't need to be something big or dramatic. It could be learning to ride a bike, drive a car, learn an instrument, passing a test that you didn't think you could….

How important is this change?

On a scale of 0 to 10 with 0 being very unimportant and 10 being very important, how important is it for you to make this change?

How confident do you feel about making this change?

On a scale of 0 – 10 with 0 being not at all ready and 10 being very ready, how confident are you to make a change?

Support for making changes

In order for changes to be successful we need to make certain that we do a few things. One of these is to make an action plan and stick to it. We will look at that in a minute. The other important thing to do is to work out who will help and support you to make a change. Now, it's easy to choose someone who you know will not give you a hard time. For example, when I first tried to give up smoking I chose a fellow smoker. That was not a good choice. When my friend saw me starting to crack and want a cigarette, he said things like 'I'm sure one cigarette won't hurt'. That was not the type of support I needed.

The type of support you need is someone who will celebrate your successes and help you to stay on track.

He or she will be able to remind you of how you have the capability to do what you want.

He or she will be able to remind you of the benefits of making changes and how you have managed to do things in the past which have also been difficult.

Think now about who that right person will be:

How do you want that person to be? Write your instructions for that person. So, for example, you could ask the person to be kind but firm. You could ask that person to remind you of the positives about what you are doing, and to remind you that you can do it.

Action Planning

The most important things you can do to make changes to manage your health, is to make an action plan, to follow it through, to review it, and then to continually review your progress.

These next few pages will take you through those steps and will help you to think about the important hurdles you may have to overcome, ways of doing that. You will also see how you can monitor your achievements.

Now that you have chosen the general area you would like to change, think about what one thing that you can do now.

Now you are ready to create your own action plan

Action plans work when they contain things **(what)** that you decide you want to do, you decide **when** you want to do them and **how** you are going to do them. Don't make them unrealistic or too difficult otherwise they will only become demoralising.

For example, my action plan about becoming more mobile could be:

Tomorrow at 8:30 am I will walk up and down the stairs *x* number of times.

So, an action plan needs

What you are going to do

When you are going to do it

Where you are going to do it

You don’t need to make big changes and your changes don’t need to happen all at once. It’s better if you build up gradually. If you have decided to increase your walking, you may want to add an additional 1,000 steps for 3 days a week in one week. The following week, you could add an additional 1,000 steps for 5 days onto that.

Week 1: Start step count _____ + 1,000 steps = _____ on 3 days

Week 2: Start step count _____ + 1,000 steps = _____ on 5 days

So to start your plan:

Think about answers to the following questions. Once you are complete, check them over.

✔What is it you are going to do?

✔When will you do it? (make certain that you will plan to do it this week but set a specific time and day)

✔How often will you do it - every day, every other day, twice a day?

✔What reminders will you use (i.e. an alarm, a reminder on your phone, or just a specific time in the day such as *immediately after work* or *every lunch time*)

✔Who will support you?

✔You will have given instructions to your support person and how you want that person to be.

✔You will have placed a reminder in your calendar or diary about the activities you will do and when.

✔You will have downloaded the action plan from the learning resource section, filled it out, submitted one copy to the assignment section in week 1 and printed out the other copy to keep

✔You will have placed your action plan in a prominent place where it will act as a reminder.

Place it on the fridge, or at the front door. Just don't hide it away.

Now that you have a plan, look back again at how confident you are, how important this is and reflect on how it will feel when you have succeeded.

We will come back to look at your progress next week. Place a note in the calendar to remind yourself when to review your progress (Monday – week 2 – the 8th of May).

NB: Remember: You should use your physical activity diary to record your progress every day. You can record your daily activity on your mobile phone or the groupwise calendar and then transfer the information to the diary at the end of the week

See you next week.

Appendix 4: Questionnaire Piloting

Introduction

The Theory of Planned Behaviour questionnaire was constructed following the guidelines of Francis, Eccles, Johnston, et al. (2004), who had previously gathered evidence and guidance from other sources such as those produced by Conner and Sparks (1995) and Ajzen ((1988) in Francis et al., 2004). The guidelines do not obviate the importance of examining the other approaches and rationale. However, it enables behavioural change research to maximise on distillation of these approaches in a pragmatic and theoretically conducive manner. Importantly, using a set of guidelines assists in establishing a literature base where the use of a questionnaire has been designed according to the same principles and guidelines. This provides confidence that there is a standardised measurement of outcomes which in tur facilitates critical analysis to discern what works in behavioural prediction and change (Craig et al., 2008, Michie et al., 2004).

The first step in the questionnaire construction requires the creation of an elicitation questionnaire that will draw on the salient beliefs of the target behaviour in relation to the population group. The execution of this phase of the project is reinforced by other authors who outline the dangers of making assumptions about any given populations' expected evaluations of outcomes (Middlestadt, 2012)

The initial task is to define both the population and the target behaviour explicitly for which Frances et al., (2004) recommend the use of the TACT principle: Target, Action, Context and Time, to define the behaviour in question. The behavioural target is defined as the government guidelines of increasing physical activity, the action was achieving 30 minutes of physical activity, the context is set for anywhere i.e. home or work and the time is 30 minutes a day on 5 days a week. The population focus was staff and students at the University of the Highlands and Islands in Scotland (UHI).

A questionnaire was devised to elicit attitudinal beliefs, both affective and instrumental, perceived subjective norms and perceptions of control and confidence. The questionnaire asks individuals about the advantages and disadvantages of undertaking 30 minutes of physical activity 5 days a week; whether there were any people who would approve or disapprove of the participant undertaking this amount of physical activity; and whether there were any factors or circumstances that would prevent/act as barriers, to enabling the physical activity to take place. And lastly, participants were

asked what facilitated or would enable them to undertake this level of physical activity.

Method

Stage 1: Elicitation of salient beliefs about physical activity

Aim: to develop a physical activity theory of planned behaviour questionnaire informed by the beliefs and attitudes of the population

Participants: Opportunistic sampling was used, where participants were drawn from the student and staff population within an online degree programme of the University of the Highlands and Islands who used the blackboard virtual learning environment.
Inclusion criteria: Aged between 18 – 65 years old
Do not have mobility problems or chronic illness which would restrict their engagement in physical activity
Do not currently exercise 30 minutes a day 5 days per week
Do not have mental health problems or learning difficulties which would preclude their engagement in the intervention
Can speak, write and understand English
Wish to participate

Ethics: The participants were provided with a participant information sheet outlining the nature of the study, the confidentiality arrangements and ethical approval body. The options of withdrawing from the study at any time, as well as withdrawing any associated data, choosing to not answer any question/s as well as the complaints procedure were all outlined to participants before engagement on the study. Ethical approval was received from Queen Margaret University Ethics Committee and University of the Highlands and Islands Ethics Committee.

Exclusion Criteria:
Age – less than 18 and over 65
Individuals who do not speak, understand and write in English
Individuals who have mobility problems or chronic health which preclude involvement in physical activity
Individuals who have learning difficulties or mental health conditions which preclude ability to engage in the intervention

The inclusion/exclusion criteria set was to ensure that there were no impinging factors which would impede someone's capacity to undertake physical activity.

Design: Qualitative Semi-structured questionnaire design (Jansen, 2010) with a single cohort.

Procedure: An email invitation was issued to all students and staff who used the blackboard virtual learning environment as part of the BA Child and Youth Studies programme (N=430) for phase one.

All participants who responded positively to the invitation received a questionnaire to complete designed to elicit their beliefs and attitudes about physical activity.

Results: Altogether 12 people responded and completed the questionnaire, initially 7 people completed the questionnaire, which was followed by a second invitation to participate to which a further 5 responded. Although Godin and Kok (1996) recommend a sample size of 25, this requirement needs to be tempered with the literature which advises that sampling should extinguish when the data being gathered has reached the point of saturation (Francis et al., 2004; Jansen, 2010) which was evident by this point. In other words, when no new evidence is emerging, then the key ideas/issues are deemed to have been identified (Searle, 1998).

The salient belief responses were collated on a table specific to each question as per Frances et al. (2004) guidelines. Responses to the questions were reviewed and entered into a conceptual analysis (Francis et al 2004) for each of the core beliefs of Intention, Attitudes, Perceived Behavioural Control and Subjective Norm. Francis et al. (2004) recommend that the concepts that are raised are measured by the number of times they are noted and prioritised according to frequency of times mentioned in the data. The categories were rated and 25 % were checked by a second researcher. Where there were discrepancies, these were resolved through discussion.

Indirect measurement of Attitude: '***What do you believe are the advantages of exercising 5 days a week for 30 minutes a day'*** The most frequently listed responses were:
To feel better about myself
Give me a better sense of wellbeing

Enable me to think more clearly
Make me fitter
Enable me to manage stress better
To have less stress
'what do you believe are the disadvantages of exercising 5 days a week 30 minutes a day' The most frequently listed responses were:
'none'
not possible due to family and work pressures
Finding time
Tiredness
possibility of physical injury and sweatiness (x 2)
Indirect measurement of Perceived Behavioural Control ***What factors or circumstances' make it difficult or impossible for you to be able to exercise 5 days a week for 30 minutes a day'*** The most frequently listed responses were:
Time
Stressed
Tired
Other people need me to do things
What factors or circumstances enable you to exercise 5 days a week for 30 minutes a day The most frequently listed responses were:
Time
Not being stressed
Not being tired
When others do not need me to do things
Are there any other issues which come to mind when you think about physical activities The most frequently listed responses were:
No / None
Household chores and daily activities
Weather
Subjective norms: Can you think of any individuals who would approve of you exercising 5 days a week for 30 minutes a day
Doctor
Family
Friends
Partner/husband/boyfriend

Can you think of any individuals who would disapprove of you exercising 5 days a week for 30 minutes a day?
None

Discussion:

The salient beliefs that emerged in the first phase of the project were compatible with those identified in previous elicitation of PA belief studies (French, Sutton, Hennings, Mitchell, Wareham et al., 2005). The barriers are commonly identified in PA/exercise research as time, weather and tiredness. Positive anticipated outcomes similarly are in accordance with previous literature in physical activity where feeling better physically and cognitively regularly dominate the responses (French et al., 2005; Hamilton and White, 2010). Family, friends and doctors are also not unusual in terms of the identification of individuals who would approve /disapprove (French et al., 2005). The data from the question on 'any other issues' did not add to the concepts already gathered from the other questions posed above apart from the recognition that household chores and daily activities were identified by the cohort as an effective means of achieving the government targets.

The questionnaire to examine the constructs of theory of planned behaviour for physical activity of 30 minutes a day 5 days a week was constructed at the end of this analysis and consultation period in preparation for phase 2 piloting.

PHASE 1:

Participant Information Sheet

Questionnaire

Participant Information Sheet Eliciting Salient Beliefs Questionnaire

A pilot study to elicit salient beliefs about physical activity

Invitation paragraph

Thank you for taking the time to read this form. Physical Activity is one of the target behaviours that the UK government seeks to increase. Physical activity guidelines have been issued by the government about the amount of physical activity that people should achieve in any week. This level of activity has been set on the basis of evidence which shows it can help to protect people from certain diseases such as coronary heart disease, stroke and diabetes.

What is the purpose of the study?

We are interested in the beliefs that people have about engaging in physical activity. This will help to inform further research about how to support people in setting physical activity goals.

Why have I been invited?

We have asked you as you are between the ages of 16 and 65 and do not have a condition which puts you in chronic pain or limited mobility.

Do I have to take part?

No it is voluntary and up to you to decide

What will happen if I take part?

If you agree to take part in this study you should complete the attached forms. You need do nothing more. Any follow on study will not necessarily select the same participants.

What are the risks of taking part in this study?

There are no risks. All care will be taken in protecting your information. Your information will be anonymous All the information we collect will be kept confidential and will be stored in a locked cabinet and the information will be anonymous.

What are the benefits of taking part?

The results of the study will be used to inform a further study to implement a toolkit to develop action plans for increasing physical activity. You will be invited to be included in this subsequent project however you are under no obligation to do so.

What will happen to the results of the study?

A report will be generated from the study which may result in a publication; there will be no information in this which will identify you.

Who can I contact for more information?

Wendy Maltinsky

Principal Researcher Telephone: 01463 273291

Thank you for taking the time to read this information

Eliciting Salient Beliefs about Physical Activity Questionnaire

(Phase 1)

In order to protect anonymity of your questionnaire but also to allow us to use the information to conduct research, we would like you to provide the following information. This code will be used to identify your questionnaires but cannot identify who you are.

1. Please write the day of the month on which you were born (e.g., 4th, 31st, 3rd)

2. Please write in the first letter of your mother's first name (e.g., A, E, B)

3. Please write in the last two letters of your home postcode

4. Please write in the last two digits of your home telephone number (e.g., 02, 98)_

Back ground information:

Age:

16 – 25 26 – 35 36 – 45 46 – 55 56 - 65

Occupation:

Before you complete this questionnaire, please

Read the attached information sheet about the government guidelines on activity.

Then complete the questionnaire about your current level of physical activity.

Lastly, please complete the questions below:

Eliciting Salient Beliefs about Physical Activity Questionnaire:

What do you believe are the advantages of you doing physical activity for 30 minutes on 5 days a week in the next fortnight?

What do you believe are the disadvantages of you doing physical activity for 30 minutes 5 days a week in the next fortnight?

Is there anything else you associate with doing physical activity on 5 days a week for 30 minutes in the next fortnight?

Are there any individuals or groups who would approve of you doing physical activity on 5 days a week for 30 minutes in the next fortnight?

Are there any individuals or groups who would disapprove of you doing physical activity on 5 days a week for 30 minutes in the next fortnight?

What factors or circumstances would enable you to do physical activity on 5 days a week for 30 minutes in the next fortnight?

What factors or circumstances would make it difficult or impossible for you to do physical activity for 30 minutes in the next fortnight?

End of questionnaire

Thank you for taking the time to complete this questionnaire.

Phase 2:

Aim: To test for both content and face validity of the questionnaire developed following phase one of the study with different participants of the same population and with health psychologists

The questionnaire drew on the previous phase of the project in its construction and employed the most salient beliefs.

Method: The questionnaire was constructed following guidance set out by Francis et al (2004)

Using the results from phase one a questionnaire was constructed using the salient beliefs that emerged.
The questionnaire employed Likert scale questions using the evaluative scales of strongly agree to strongly disagree and very desirable to very undesirable.
Participants: An email sent to all staff and students of UHI Inverness College. A unique cohort to those self-selected above was taken, which was an additional exclusion criteria for this phase of the project only: 'not participated in phase 1 of this study – the elicitation of beliefs about physical activity questionnaire'. This was established in order to ensure that the questionnaire could be measured against the views of different respondents.

Inclusion criteria remained the same as for phase one;
Inclusion criteria:
Aged between 18 – 65 years old
Do not have mobility problems or chronic illness which would restrict their engagement in physical activity
Do not currently exercise 30 minutes a day 5 days per week
Do not have mental health problems or learning difficulties which would preclude their engagement in the intervention
Can speak, write and understand English
Wish to participate
Not participated in phase 1 – elicitation of physical activity belief question

Procedure: All participants (N=5; + 3 health psychologists) received a draft theory of planned behaviour about physical activity questionnaire. Attached to the questionnaire was another questionnaire in which participants were asked to comment on and evaluate the TPB PA questionnaire. The construction of this phase of the development of the TPB again follows the guidelines set out by Francis et al. (2004).
• Are any items ambiguous or difficult to answer?
• Does the questionnaire feel too repetitive?
• Does it feel too long?
• Does it feel too superficial?
• Are there any annoying features of the wording or formatting?
• Are there inconsistent responses that might indicate that changes in response endpoints are problematic for respondents who complete the questionnaire quickly?

To Health Psychologists
In addition to the questions above, two additional questions were asked: There is a risk of response set due to the ordering of the scales – what are your views about this risk. What benefits are there to introducing mixed scales and reverse order questions?

Do the questions appear to be asking what they should be asking?

Direct Measurement:
Intention
In the measurement of intention, it was decided to use the generalised intention framework where participants are faced with three options which when combined create an intention score. Literature indicates that this generalised intention has high internal consistency (Armitage & Conner, 2001). Frances et al. (2004) recommend this approach for behaviour which examines an individual's own health behaviour.

I intend to exercise for 30 minutes a day 5 days a week.

I want to exercise for 30 minutes a day 5 days a week

I expect to exercise for 30 minutes a day 5 days a week

The items were each measured by using a 7 point Likert scale along the continuum of strongly disagree to Strongly Agree.

Range of responses is: 3 (1 + 1 + 1) to (7 + 7 + 7) 21 and calculated to find the mean.

Indirect Measurements:
In the measurement of attitude, perceived behavioural control and subjective norm, questionnaire items were devised by employing the indirect measurement of each construct.

Attitude
Attitude was measured using indirect measures based on 5 behavioural beliefs about the advantages of physical activity and 5 corresponding outcome evaluations of these beliefs.
The questionnaire items were constructed using a 7 point Likert scale. Attitude scores were calculated by multiplying the behavioural belief by the associated outcome evaluation across each belief, and adding each of

these sums together to emerge with a composite attitude score and finding the mean of these scores.
5 pairs of items were used
Undertaking physical activity will make me feel better about myself (strongly agree to strongly disagree
How desirable is: Feeling better about myself is (from highly desirable to not at all desirable)
Given the 7 point scale the possible maximum and minimum response was
(7 x 7) + (7 x 7) + (7 x 7) + (7 x 7) + (7 x 7) = 245
(1 x 1) + (1 x 1) + (1 x 1) + (1 x 1) + (1 x 1) = 5

Subjective Norm:
The measure of subjective norm was similarly measured by constructing items reflecting the most regularly noted social referents – partner/husband; friends; doctor as well as an evaluation of the importance of adhering to the norms of these individual/s.
Again the final measurement score was calculated according to guidance by Francis et al (2004) by multiplying each social referent approval by the corresponding evaluation of **Motivation to comply with others** was measured:

The possible maximum and minimum response was:
(7 x 7) + (7 x 7) + (7 x 7) 147

(1 x 1) + (1 x 1) + (1 x 1) = 3

Subjective norm was also measured to identify what 'others' were currently being perceived as doing in terms of physical activity
How many of your close friends or family currently exercise for 30 minutes a day 5 days a week?
Number of friends and family exercising: none, few many, all

Perceived Behavioural Control:
Was measured by constructing a series of 4 items to measure self-efficacy:

How confident are you that you can exercise 30 minutes a day 5 days a week even when you feel
Stressed,
Busy,
Other people need me to do things
Tired
Controllability

Whether or not I exercise for 30 minutes a day 5 days a week is entirely up to me

Current Behaviour

Finally to gauge past behaviour (self-recorded), the following statement using a 7 point Likert scale of disagree to agree, was inserted:

I currently exercise for 30 minutes a day 5 days a week

Results:

N = 5 + 3 health psychologists

Participants felt that the questionnaire was 'simple, easy to understand and did not take a long time to complete'.

Some suggestions were made regarding formatting, where upper case lettering was noted by one participant as required for the start of each question. Similarly a change of format occurred accidentally in the questionnaire and this too was pointed out as needing attention to ensure consistent formatting.

Participants had been asked if the questions should randomise the direction of the poles to which different opinions gathered. Some of the health psychologists were concerned that participants may not notice the direction of the poles changing which may result in inaccurate recordings. However, one psychologist believed that adapting the order and alternating questionnaire terminal points would prevent a response bias.

Discussion

The results indicated that some changes needed to be made to the formatting of the questionnaire, but there were no difficulties recorded for the wording of the questionnaire. This exercise in ensuring ease of understanding and appropriate formatting is one important step to ensuring that participants understand and can easily read the questions (Boynton and Greenhalgh, 2004). Responses to the question regarding whether alternating the direction of the endpoint between items in a questionnaire should be undertaken, were mixed. There is sufficient evidence in the literature to call to question this approach (Frances et al 2004). The mixing of end points is considered as a valuable technique to avoid response sets (Rattray and Jones, 2007), however where there is any automaticity of response, this can render the data set unreliable (Giles et al., 2007).
It was decided to be consistent in the direction of the scale. While there is some speculation as to the extent to which participants can become lazy in

their completion of questionnaires when the direction of the scale is universally applied (Rattray and Jones, 2007), there are opposing views that reversing the scales can result in individuals recording their intended response incorrectly, assuming without accurate reading, that the scales are all in one direction (Jacoby, Thomas, Soutter et al., 2007).
With these results, the final questionnaire was constructed implementing the formatting recommendations.

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Health Action Planning Tool

Evaluation Questionnaire (Piloting Questionnaire – Phase 2)

This questionnaire is designed to gather information about your attitudes and beliefs about undertaking physical activity for 30 minutes 5 days a week. Please answer all the questions as best you can.
The information you provide is completely confidential and your input is greatly appreciated. You do not need to answer any question you choose not to. If you wish not to complete this questionnaire, you are under no obligation to do so.

The questionnaire will take approximately 5 minutes to complete.

To protect the anonymity of your questionnaire but to also allow us to use the information to conduct research, we would like you to provide the following information. This code will be used to identify your questionnaires but cannot identify who you are.

Instructions: Place your cursor over the gray shading. It will allow you to write into this space.
Where there are boxes from which to select an option, place the cursor over the gray shaded box of your choice and click on the box. The cursor will only allow you to make one selection on each question line.

1. Please write the day of the month on which you were born (e.g., 4th, 31st, 3rd)
2. Please write in the first letter of your mother's first name (e.g., A, E, B)
3. Please write in the last two letters of your home postcode
4. Please write in the last two digits of your home telephone number (e.g., 02, 98)

Background information

Today's Date

Age:

16 – 25 ☐ 26 – 35 ☐ 36 – 45 ☐ 46 – 55 ☐ 56 - 65 ☐

Occupation:

Lecturer ☐ Student ☐ Administration ☐ Management ☐ Other ☐

Please turn to the following page 

Health Action Planning Study: Attitudes

Undertaking physical activity for 30 minutes a day for 5 days a week will:

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
Make me feel better about myself	☐	☐	☐	☐	☐	☐	☐
Give me a better sense of wellbeing	☐	☐	☐	☐	☐	☐	☐
Will enable me to think more clearly.	☐	☐	☐	☐	☐	☐	☐
Make me more fit	☐	☐	☐	☐	☐	☐	☐
Enable me to manage stress better	☐	☐	☐	☐	☐	☐	☐

How desirable are the following

	very undesirable						very desirable
Feeling better about myself	☐	☐	☐	☐	☐	☐	☐
Having a better sense of wellbeing	☐	☐	☐	☐	☐	☐	☐
Thinking more clearly.	☐	☐	☐	☐	☐	☐	☐
Being more fit	☐	☐	☐	☐	☐	☐	☐
managing stress better	☐	☐	☐	☐	☐	☐	☐

How would you describe undertaking physical activity for 30 minutes a day 5 days a week

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
Pleasurable	☐	☐	☐	☐	☐	☐	☐
Enjoyable	☐	☐	☐	☐	☐	☐	☐
Good	☐	☐	☐	☐	☐	☐	☐
Useful	☐	☐	☐	☐	☐	☐	☐
Satisfying	☐	☐	☐	☐	☐	☐	☐

Please turn to following page 

Views of others:

To what extent would the following people approve of you undertaking exercise for 30 minutes 5 days a week:

	Strongly disapprove			Neither approve nor disapprove			Strongly approve
Doctor (GP)	☐	☐	☐	☐	☐	☐	☐
Partner/significant other	☐	☐	☐	☐	☐	☐	☐
Friends	☐	☐	☐	☐	☐	☐	☐

To what extent do you agree with the following statement?
The views that others (Doctor (GP); partner/significant other; friends) have about my exercising is important to me:

	Strongly disapprove			Neither approve nor disapprove			Strongly approve
Doctor (GP)	☐	☐	☐	☐	☐	☐	☐
Partner/significant other	☐	☐	☐	☐	☐	☐	☐
Friends	☐	☐	☐	☐	☐	☐	☐

Please turn to following page 

Please indicate the extent to which you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
I intend to exercise for 30 minutes a day 5 days a week.	☐	☐	☐	☐	☐	☐	☐
I want to exercise for 30 minutes a day 5 days a week	☐	☐	☐	☐	☐	☐	☐
I expect to exercise for 30 minutes a day 5 days a week	☐	☐	☐	☐	☐	☐	☐
Whether or not I exercise for 30 minutes a day 5 days a week is entirely up to me	☐	☐	☐	☐	☐	☐	☐

How confident are you that you can undertake physical activity for 30 minutes a day 5 times a week

	Very under-confident						Very confident
Stressed	☐	☐	☐	☐	☐	☐	☐
Busy	☐	☐	☐	☐	☐	☐	☐
Other people need me to do things	☐	☐	☐	☐	☐	☐	☐
Tired……	☐	☐	☐	☐	☐	☐	☐
Stressed	☐	☐	☐	☐	☐	☐	☐

Please turn to following page

- Are any items ambiguous or difficult to answer?
- Does the questionnaire feel too repetitive?
- Does it feel too long?
- Does it feel too superficial?
- Are there any annoying features of the wording or formatting?
- Are there inconsistent responses that might indicate that changes in response endpoints are problematic for respondents who complete the questionnaire quickly?

End of Questionnaire
Thank you for your time
If you have any questions about this questionnaire, you may contact Wendy Maltinsky on wendy.maltinsky@inverness.uhi.ac.uk

Appendix 5: Questionnaires

TPB Questionnaires (Pre-test and Post-test) (Acceptability questions for Intervention Participants are at the end of the questionnaire)

Health Action Planning Tool
Evaluation Questionnaire

This questionnaire is designed to gather information about your attitudes and beliefs about undertaking physical activity for 30 minutes 5 days a week.
Please answer all the questions as best you can.
The information you provide is completely confidential and your input is greatly appreciated. You do not need to answer any question you choose not to. If you wish not to complete this questionnaire, you are under no obligation to do so.

The questionnaire will take 5 minutes to complete.

To protect the anonymity of your questionnaire but to also allow us to use the information to conduct research, we would like you to provide the following information. This code will be used to identify your questionnaires but cannot identify who you are.

Instructions: Place your cursor over the grey shading. It will allow you to write into this space.
Where there are boxes from which to select an option, place the cursor over the grey shaded box of your choice and click on the box. The cursor will only allow you to make one selection on each question line.

1. Please write the day of the month on which you were born (e.g., 4th, 31st, 3rd)

2. Please write in the first letter of your mother's first name (e.g., A, E, B)

3. Please write in the last two letters of your home postcode

4. Please write in the last two digits of your home telephone number (e.g., 02, 98)

Background information

Today's Date

Age:

16 – 25 ☐ 26 – 35 ☐ 36 – 45 ☐ 46 – 55 ☐ 56 - 65 ☐

Occupation: Lecturer ☐ Student ☐ Administration ☐ Management ☐ Other ☐

Please turn to the following page →

Health Action Planning Study: Attitudes

Undertaking physical activity for 30 minutes a day for 5 days a week will:

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
Make me feel better about myself	☐	☐	☐	☐	☐	☐	☐
Give me a better sense of wellbeing	☐	☐	☐	☐	☐	☐	☐
Will enable me to think more clearly.	☐	☐	☐	☐	☐	☐	☐
Make me more fit	☐	☐	☐	☐	☐	☐	☐
Enable me to manage stress better	☐	☐	☐	☐	☐	☐	☐

How desirable are the following

	very undesirable						very desirable
Feeling better about myself	☐	☐	☐	☐	☐	☐	☐
Having a better sense of wellbeing	☐	☐	☐	☐	☐	☐	☐
Thinking more clearly.	☐	☐	☐	☐	☐	☐	☐
Being more fit	☐	☐	☐	☐	☐	☐	☐
managing stress better	☐	☐	☐	☐	☐	☐	☐

How would you describe undertaking physical activity for 30 minutes a day 5 days a week

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
Pleasurable	☐	☐	☐	☐	☐	☐	☐
Enjoyable	☐	☐	☐	☐	☐	☐	☐
Good	☐	☐	☐	☐	☐	☐	☐
Useful	☐	☐	☐	☐	☐	☐	☐
Satisfying	☐	☐	☐	☐	☐	☐	☐

Please turn to following page 

Views of others:

To what extent would the following people approve of you undertaking exercise for 30 minutes 5 days a week:

	Strongly disapprove			Neither approve nor disapprove			Strongly approve
Doctor (GP)	☐	☐	☐	☐	☐	☐	☐
Partner/significant other	☐	☐	☐	☐	☐	☐	☐
Friends	☐	☐	☐	☐	☐	☐	☐

To what extent do you agree with the following statement?
The views that others (Doctor (GP); partner/significant other; friends) have about my exercising is important to me:

	Strongly disapprove			Neither approve nor disapprove			Strongly approve
Doctor (GP)	☐	☐	☐	☐	☐	☐	☐
Partner/significant other	☐	☐	☐	☐	☐	☐	☐
Friends	☐	☐	☐	☐	☐	☐	☐

Please turn to following page 

Please indicate the extent to which you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
I intend to exercise for 30 minutes a day 5 days a week.	☐	☐	☐	☐	☐	☐	☐
I want to exercise for 30 minutes a day 5 days a week	☐	☐	☐	☐	☐	☐	☐
I expect to exercise for 30 minutes a day 5 days a week	☐	☐	☐	☐	☐	☐	☐
Whether or not I exercise for 30 minutes a day 5 days a week is entirely up to me	☐	☐	☐	☐	☐	☐	☐
I currently exercise for 30 minutes a day 5 days a week	☐	☐	☐	☐	☐	☐	☐

How many of your close friends and family currently exercise 30 minutes a day 5 days a week

	None	Few	Many	All
Number of friends and family exercising	☐	☐	☐	☐

How confident are you that you can undertake physical activity for 30 minutes a day 5 times a week

	Very under-confident						Very confident
Stressed	☐	☐	☐	☐	☐	☐	☐
Busy	☐	☐	☐	☐	☐	☐	☐
Other people need me to do things	☐	☐	☐	☐	☐	☐	☐
Tired……	☐	☐	☐	☐	☐	☐	☐
Stressed	☐	☐	☐	☐	☐	☐	☐

Please turn to following page

Acceptability Questions

Intervention groups were issued with the following questions at the end of the post –test TPB questionnaire to assess acceptability of the intervention

The following series of questions relate to the Health Action Planning Tool you accessed online. This was the package of information and activities available to you through the Blackboard Virtual Learning Environment.

Using the Health Action Planning Tool was....

	1	2	3	4	5	6	7	
Very easy	☐	☐	☐	☐	☐	☐	☐	Very difficult
Very pleasant	☐	☐	☐	☐	☐	☐	☐	Very unpleasant
Very fun	☐	☐	☐	☐	☐	☐	☐	Very tedious
Very effective	☐	☐	☐	☐	☐	☐	☐	Very ineffective

The Health Action Planning Tool helped me to ....

	Strongly Disagree	Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Agree	Strongly Agree
Write a physical activity action plan	☐	☐	☐	☐	☐	☐	☐
Think more about the exercise I do	☐	☐	☐	☐	☐	☐	☐
Increase the physical activity I do	☐	☐	☐	☐	☐	☐	☐

Do you agree with the following statements?

	Agree	Disagree
I would recommend the Health action Planning Tool to a friend or family		
I would use it again myself		
I would like to see it available more widely		

I would like to have seen the following changes/additions to the Health Action Planning Tool

What I thought worked well in the Health Action Planning Tool was:

Indicate on the following scale, how satisfied you are that you took part in this study:

	1	2	3	4	5	6	7	
Very dissatisfied								Very satisfied

***All participants** were asked this final question*:

Any additional comments?

End of Questionnaire

Thank you for your time

If you have any questions or comments about this questionnaire, please contact wendy.maltinsky@inverness.uhi.ac.uk

Appendix 6: Sample E-mail

You are not alone in undertaking this physical activity as there is a large group of students and staff wearing pedometers and walking to health. Every day that you undertake physical activity adds to not only your overall physical health, but physical activity has been shown to also have very positive benefits on emotional health. Importantly for those undertaking essays and exams, physical activity has also been shown to have very positive benefits to cognitive capacity and functioning as well. Even short 10 minute spurts can refresh your thinking and your sense of wellbeing. You don't even have to go outside; simply stride around your work environment, or your home.

Appendix 7: Tests of normality

Tests of Normality

	intyesno	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
intention1	no	.097	43	.200*	.919	43	.005
	yes	.126	42	.090	.938	42	.024
intention2	no	.219	37	.000	.854	37	.000
	yes	.160	29	.056	.948	29	.167
Tattitude1	no	.167	44	.004	.859	44	.000
	yes	.116	42	.179	.903	42	.002
Total Subjectivenorm pre test	no	.135	42	.054	.959	42	.141
	yes	.102	43	.200*	.961	43	.157
total pbc pre test	no	.082	43	.200*	.987	43	.905
	yes	.180	42	.001	.921	42	.006
total attitude post rest	no	.206	36	.001	.788	36	.000
	yes	.163	31	.035	.826	31	.000
total subject norm post test	no	.168	35	.014	.925	35	.020
	yes	.125	29	.200*	.944	29	.127
total pbc post test	no	.111	37	.200*	.965	37	.286
	yes	.096	31	.200*	.980	31	.826
wk0total	no	.214	39	.000	.719	39	.000
	yes	.101	36	.200*	.953	36	.126
wk1TOTAL	no	.200	40	.000	.720	40	.000
	yes	.087	28	.200*	.981	28	.881
wk2TOTAL	no	.103	37	.200*	.909	37	.005
	yes	.081	27	.200*	.983	27	.925
totwk3	no	.087	32	.200*	.961	32	.292
	yes	.220	22	.007	.737	22	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Appendix 8: Sample Completed diary

Health Action Planning Tool Study

Diary of Physical Activity

In order to protect anonymity of your information but also to allow us to use the information to match to your questionnaire, please complete the following to input your unique code.

1. Please write the day of the month on which you were born (e.g., 4th, 31st, 3rd)

2. Please write in the first letter of your mother's first name (e.g., A, E, B)

3. Please write in the last two letters of your home postcode

4. Please write in the last two digits of your home telephone number (e.g., 02, 98)

Date: 9/5/11 Participant Number 18EPB18

Week 2				
	Pedometer Reading	 **Physical activity** **What did you do?**	**How long did you do it for?**	How good did you feel after your activity on a scale of 0 – 10 with 10 being very good and 0 being not at all good?
Day 1	8956	Walked to and from work, gardening in eve	Walking – 30mins, gardening – 1hour15mins	10
Day 2	7958	Walked to work and from work, went for walk in eve	Walking – 1.5 hrs total	10
Day 3	9531	Walked to and from work, went for walk in the evening	Total walking1.5 hours	10
Day 4	6522	Not much activity, went to shop during lunch	n/a	5
Day 5	7325	No walking to work, gardening in evening	45 mins gardening	7

On a scale of 0 – 10 with 0 being not at all confident and 10 being very confident, how confident are you that the pedometer reading you have entered is accurate?

Appendix 9: Sample Completed Action and Coping Plan

Week One: My Physical Activity Action Plan

✔ What is it you are going to do?

Wherever possible, walk instead of travelling by car or bus.

✔ When will you do it? (make certain that you will plan to do it this week but set specific times and days)

Walk between house and work (20 mins each way) daily, and walk to town on Friday (20 mins). 3 hours total walking = 18000 steps

✔ How often will you do it - every day, every other day, twice a day?

As above

✔ What reminders will you use (i.e. an alarm, a reminder on your phone, or just a specific time in the day such as *immediately after work* or *every lunch time*)

The pedometer has been a good reminder and motivator and is there on my bedside cabinet to remind me of my goals every morning.

✔ Who will support you? I have written instructions for my support person and how I want that person to be.

My wife will give me the gentle kick (and withhold the car keys) when I need motivation.

✔ How will you know if you have succeeded? Sometimes that's easy. If you plan to walk an additional 1,000 feet on 5 days a week, then you can simply check your pedometer. Try to be really specific with your plan so that it is easy to tell when you have achieved your target.

Pedometer

✔ On the column on the left identify what problems you might have in meeting your goal. On the column on the right, fill in how you will deal with those problems

Challenges	How I will deal with them
Laziness and lack of motivation	Look back at the results from last week
No need to leave house too often because end of semester essay workload	Purposely take a head clearing break and go for a brisk walk instead of sitting with a coffee.

Appendix 10: Binary Logistic Regression Outcome completers/non completers

Table: Bivariate Logistic Regression, predicting likelihood of submitting diaries

	B	S.E.	Wald	df	Sig.	Odds Ratio	95% C.I.for Odds Ratio	
							Lower	Upper
gender(1)	-.795	.732	1.179		.278	.452	.108	1.896
group			9.705		.021			
group(1)	-.860	.869	.979		.323	.423	.077	2.325
group(2)	-2.607	.903	8.331		.004	.074	.013	.433
group(3)	-.291	.832	.122		.726	.748	.146	3.816
age			2.518		.641			
age(1)	-.877	1.414	.385		.535	.416	.026	6.644
age(2)	-.392	1.282	.094		.760	.676	.055	8.332
age(3)	-1.326	1.327	.999		.318	.266	.020	3.577
age(4)	.104	1.294	.007		.936	1.110	.088	14.011
occup			1.988		.738			
occup(1)	.441	.889	.246		.620	1.554	.272	8.870
occup(2)	.625	1.045	.357		.550	1.867	.241	14.484
occup(3)	1.705	1.337	1.626		.202	5.504	.400	75.668
occup(4)	.198	.821	.058		.809	1.219	.244	6.090
howfartown			1.373		.712			
howfartown(1)	.553	.876	.398		.528	1.738	.312	9.678
howfartown(2)	1.036	.905	1.312		.252	2.819	.478	16.611
howfartown(3)	.637	1.214	.275		.600	1.891	.175	20.437
pbc1	.021	.048	.191		.662	1.021	.929	1.122
intention1	-.012	.093	.017		.896	.988	.824	1.184
Constant	1.525	2.451	.387		.534	4.594		

Appendix 11: Acceptability Graphs

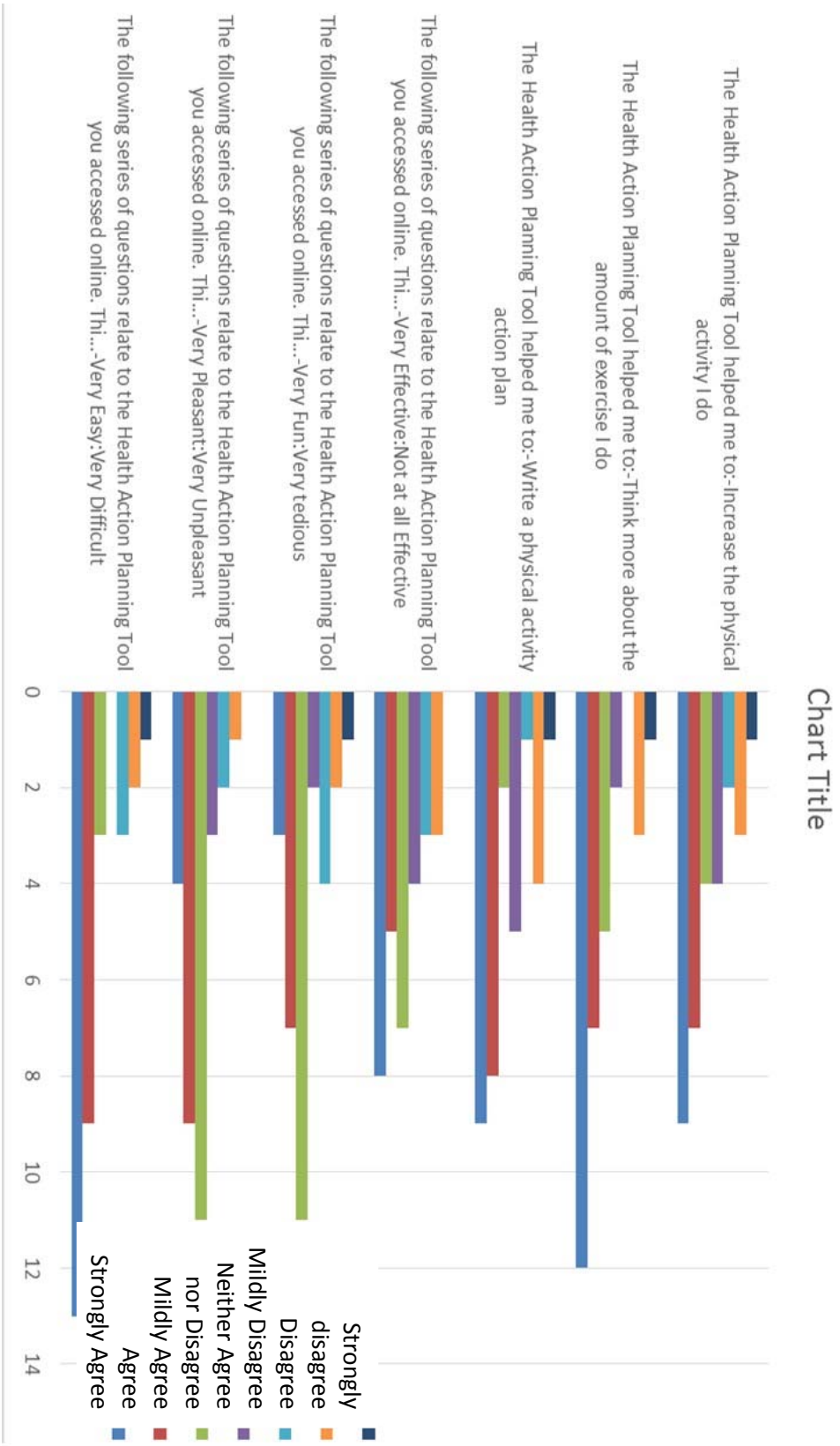
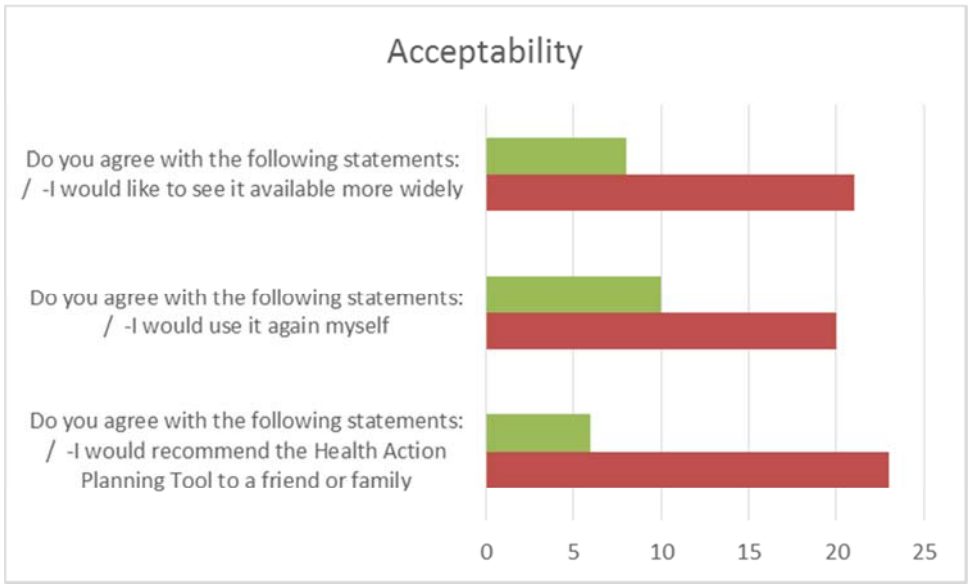


Figure: Acceptability Questions; Agree/disagreeing responses to acceptability of the availability, use of, and recommendation of the tool where red is yes and green is no



Key

	No		Yes